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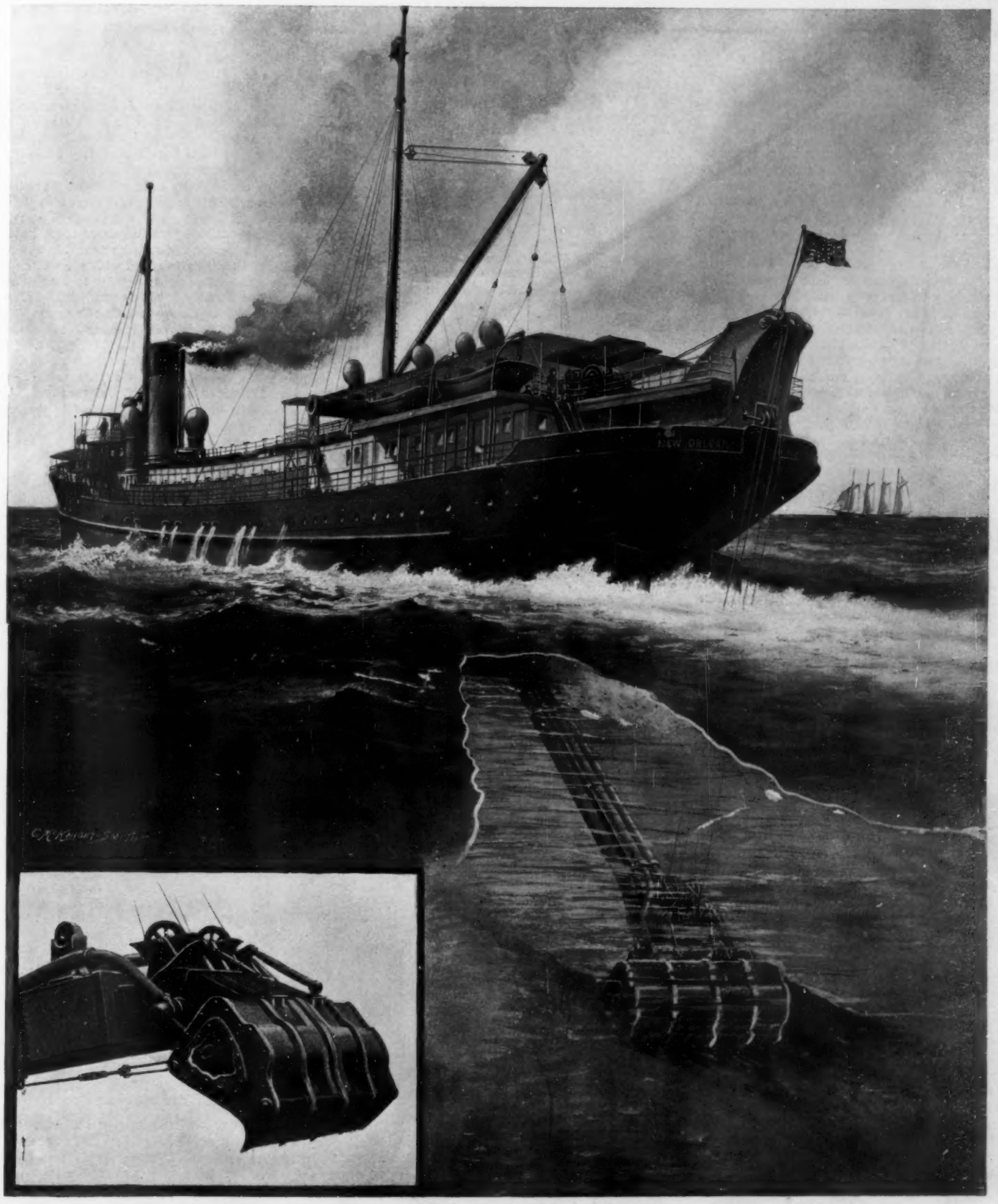

Dredge with a rake-like suction head built for service on the Southwest Pass of the Mississippi delta.

DEVOURING A HUNDRED TONS OF MUD PER MINUTE.—[See page 494.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

A Peril to the United States Navy

THE action of a majority in the House of Representatives in opposing the appropriation requested for the annual increase of the United States Navy by two battleships a year is perilous to the interests of the navy and therefore endangers the security of the United States. The term "strength" as applied to a navy is a purely relative one. A navy is strong or weak in direct proportion to the strength or weakness of those foreign navies which it may some day be called upon to engage. A few years ago the United States stood second in naval rank, a rating which is demanded by our wealth and population, and by the great value and far removed location of our foreign possessions. To-day we are in the third position, with Germany holding a strong position as second naval power and steadily gaining upon the United States in the numbers and power of its modern fleet.

Now if the fatuous policy of obstruction followed by the majority of the House of Representatives is successful, and if it be persisted in for but a few years, the United States will inevitably drop to the fourth, if not to the fifth position. Although our present relations with Japan are amicable, we cannot shut our eyes to the fact that the opening of the Panama canal will render extremely acute all questions relating to the commercial and naval control of the Pacific; and, in any disturbances which may arise in the Pacific, Japan will be our immediate and most able competitor.

Unfortunately, the natural and very proper secrecy with which Japan carries on her plans for naval increase has deluded the people of the United States into the belief that in her naval policy Japan is marking time—that the retrenchments rendered necessary by the war with Russia have prevented her from entering upon any considerable program of development. Nothing could be farther from the truth. Not only is Japan building new dreadnoughts and many of them, but her latest ships are of the largest and most efficient type. At about the same date that we launched the "Texas" there was launched at the Vickers yard in England, for the Japanese navy, a vessel which is 500 tons larger than the "Texas," which will have a speed 6 knots greater, and will carry an armament of eight 13.5-inch guns. This year, moreover, three battle-cruisers of the same speed, size, and armament are being laid down in Japanese yards.

No one is more alive to the serious significance of these facts that Mr. Meyer, the Secretary of the Navy. Frequently he has called public attention to the fact that if the House of Representatives has its way and we abandon our program of two ships a year Japan will soon possess a more powerful fleet of modern dreadnoughts than the United States. We commend to the serious consideration of the members of the House the article by Capt. Potts, of the Office of Intelligence of the Navy, on the subject of the rank of the United States among the naval powers, which was published in our issue of December 9th, 1911. In its opposition to the two-battleship program, the House is getting out of touch with the feeling and wishes of the country. Of this there is every evidence in the correspondence which reaches this journal from all sections of the United States.

Forming Gatun Lake

UPON the last day of April the gates of the spillway dam at the center of the artificial hill which has been built across the Chagres valley at Gatun were closed, and the Chagres River, swollen by the torrential floods of the rainy season, will henceforth perform its man-appointed task of forming, in the center of the Isthmus of Panama, a vast artificial lake, 100 miles in superficial area. The spillway dam has been built to elevation plus 50 above sea level, and it is probable that before the close of the rainy season, which is now due, the lake will have risen to that level. Any further rise will be prevented by opening the sluice gates in the bottom of the dam. Meanwhile, a line of piers will be built on the crest of the dam, and between them will be installed the gates by means of which the waters of the full lake will be held at the elevation of eighty-seven feet above tide level. This work will be completed in time for the rainy season of 1913, when the lake will be raised to its full height and will back up through the Culebra cut to the lock at Pedro Miguel, on the Pacific side of the mountain divide.

During the first month or two of the rainy season the rise of the lake will be rapid; but as its surface area is extended and its waters begin to spread out into the various valleys that are tributary to the Chagres, the rate of rise will slow down. As the waters creep up the face of the big dam, the many doubts which have been expressed as to the impermeability and stability of the dam will be gradually set at rest. None of the engineers on the work has the slightest doubt as to the permanence of this fine work. So great are its proportions that, already, even in its incomplete condition, it seems to form a part of the chain of undulating low hills with which nature has flanked the Chagres valley. When the slopes of the dam have been smoothed off and have become overgrown with tropical growth, the illusion will be even more complete. The Gatun dam is a gigantic work, daringly conceived and most ably carried out. Once completed, it will stand as a barrier across the Chagres valley for all time to come.

Preserve City Hall Park

IN view of the widespread interest in the question of beautifying our cities by the creation of public plazas and civic centers of proper dignity enriched with appropriate architecture, we do not hesitate to call attention to the present commendable agitation for the removal of the present unsightly Federal Post Office in this city from City Hall Square, and the restoration of the site to the park from which it was taken.

When the present site was ceded to the Federal Government for the erection of a post office, provision was made that it should revert to the city if the post office should ever be abandoned, and now that the urgent need for a new post office is recognized, the long-wished-for opportunity is presented of restoring a considerable section of City Hall Park to its proper purposes.

There is now before Congress a bill which provides for the removal of the Post Office Building and the erection elsewhere of a building to house the postal service and the Federal Courts. A precedent for the present agitation is afforded by the recent successful fight for the construction of the new court house elsewhere than in City Hall Park. Within a few years the old County Court House in the park will have been removed and a new court house will have been completed in the vicinity of the new city Municipal Building.

The questions involved in the case of the Post Office Building are the same as those which came up for discussion in the matter of the new County Court House. Then, as now, powerful influences were at work to have the new building erected upon the site of the present structure. This would have meant a further encroachment upon the park. The arguments against the construction of the court house apply with equal force to the erection of the new post office.

The efforts of those who have the improvement of the city at heart have been directed to the forming of an imposing municipal center, of which the fine city building will be the most conspicuous feature. It is hoped that the Federal Government will contribute to this worthy object by erecting the new Post Office Building on the site which the city is about to acquire north of the present Municipal Building.

Ozone Sterilization

ORDINARILY sterilizing agents are not always pleasant, but there is a fascination about the use of "electrified air." There are no repugnant residues after ozone has attacked organic matter, whether it be in drinking water, in the air or on hospital bandages. In other words, ozone burns up decaying and dangerous organic matter into harmless products.

This magic gas, merely oxygen in a more active form, is obligingly made for us by nature through the action of the sunlight and electric stress in the atmosphere. But so quickly does it pounce upon dirt, that around cities we find little or no ozone. Some authorities consider it nature's purifier. Man has learned to imitate one of nature's methods of making it, and now many types of electric ozonizers are on the market, all depending on the fact that when electricity under a pressure of several thousand volts jumps silently across an air gap, part of the oxygen in the air is converted into ozone.

One part in a million of air is bracing in its effect, the results being like those of the best mountain air, and the organic sewage thrown off by people's lungs is readily burned up. This air sewage is the cause of stuffiness, headache and depression when people crowd together indoors. It is a genuine poison; but ozone renders it harmless. In this connection it is well to take the claims of manufacturers of ozone machines with a grain of salt. Enough ozone to kill bacteria in the air will be extremely unpleasant if not positively injurious. Its value in improving the air of churches, theaters and houses lies solely in the destruction of air sewage. Indirectly, this keeps down the number of bacteria; for they need the air sewage as food, and the oxidation of their food checks their increase.

The stimulating effect of slightly ozonized air is like that of the pine woods or mountains or seashore, and possibly for the same reason. Physicians in London and Paris report great benefit by its use in cases of anemia, incipient tuberculosis, whooping cough, etc. Recently a completely equipped hospital for the study of ozone as an aid in therapeutics has been installed in London.

To purify drinking water greater concentrations are required, too great for safe or pleasant breathing. The highly ozonized air is mixed with the water and kills bacteria as well as removing odor and taste from very bad water. Muddy water is rough-filtered first. One hundred cities in Europe including Paris and St. Petersburg are purifying their municipal supplies in this way. Paris has a plant at St. Maur with a capacity of twenty million gallons in twenty-four hours. A few plants are in operation in America, notably in Baltimore, Ann Arbor and Linsay, Ontario. A Chicago firm sells a small ozonizer to be attached to the household faucet. It consumes electricity only when the water is running.

As a deodorizer ozone is wonderful. Public toilets, club rooms reeking with cigar smoke, storage cellars, restaurants—all respond to this means of purification. A large number of banks and other business houses stimulate their clerks to their level best by making the air invigorating with a dash of ozone. The cost of running a machine adequate for a church or small theater is no more than that of two sixteen-candle power lights. One hundred and fifty dollars will buy a large machine, and household sizes may be secured for less than fifty dollars. Leading hospitals sterilize bandages and instruments by exposure to very strong ozonized air. As an adjunct to the cold storage preservation of fruit there are great possibilities. Less refrigeration is required if the atmosphere is charged with ozone, for it prevents the growth of the organisms of decay. Brewers already use the gas to sterilize casks and vaults, and to some extent to age beer.

Outside the bactericidal field ozone has a commercial use as a harmless bleaching agent. Flour, for example, has been whitened by nitric oxide gas; but the determined opposition of the government pure food department has directed attention to the fact that ozone will bleach the yellowest wheat flour to a pure white with no possibility of danger to the public health. For that matter sugar, oils, starch, textiles and the delicate ostrich plumes are thoroughly and safely bleached.

A great drawback to the more general use of this valuable gas is its extreme instability. Cylinders of it cannot be shipped as can be done with oxygen, for, unfortunately, ozone rapidly decomposes into the oxygen from which it was made. Heat and moisture are both unfavorable to its preservation. The Steynis system of making large quantities of it for industrial use avoids this danger to some extent. In this process the air to be treated is first dried and chilled.

Investigation in this field has received a tremendous impetus in the last decade, and much more is to be expected in the next.

A Trans-Cuban Canal

A REPORT from the American Minister at Havana states that plans are being actively discussed in Cuba to construct a canal across that island from Cardenas, on the north, to the Bahia de los Cochinos, on the south, in order to shorten the route of steamers from the Atlantic ports of the United States to Panama. A sea-level canal is contemplated, having the same width and depth as the Panama canal, and the cost is estimated at $90,000,000. One of the promoters of the project is Señor Joaquin Chalons y Gonzalez, until recently secretary of public works.

Engineering

Passengers Assigned to Lifeboats.—The steamship "Rotterdam" of the Holland-America Line, on her last voyage to this port, carried ten extra lifeboats, making in all thirty-four. There was a card in each cabin, inscribed with the name and number of the lifeboat to which the occupants were assigned, and also a diagram showing its position on the boat deck. These are some of the first fruits of the recent disaster.

A Drydock for the Largest Ocean Ships.—We are heartily in agreement with Dock Commissioner Calvin Tomkins in his recommendation that a drydock should be built at this port, large enough to accommodate the biggest ocean liners. As matters now stand, if a ship like the "Titanic" should come into port, seriously disabled, there is no dock that could accommodate her. It is possible that a ship of this size, if she reached an American port seriously damaged below the water line, would nevertheless be a total loss because of the impossibility of making the necessary underwater repairs.

Canal Work in April.—The grand total of canal excavations to May 1st was 168,486,884 cubic yards, leaving to be excavated 26,836,495 cubic yards, which is less than one-sixth of the entire amount to be taken out for the whole work. The total for April was 2,764,283 cubic yards as compared with 2,691,763 cubic yards in April, 1911. Over 93 per cent of the concrete for the three twin locks at Gatun has been laid, and at the two twin locks at Pedro Miguel work has been carried to the same extent of completion. At Miraflores over 64 per cent of the concrete has been laid.

A Naval Architect on Safe Ships.—Otto Kretschmer, Dean of the Marine Engineering Department of the Charlottenburg Technical High School, has drawn attention to his plans for an unsinkable transatlantic ship. In them he embodies the principle of constructing a hull within a hull. The inner body, which is entirely independent of the outer, contains all the engines and boilers, and it is walled in with steel plating, through which there are no communicating doors between the outer and inner structures. This, as we have shown in these columns, is the only principle of construction on which a practically unsinkable ship can be built.

Automatic Stops on Railways.—The fact that from June 7th, 1911, to March 13th, 1912, running past danger signals resulted in the death of 171 persons and the injury of 931, emphasizes the importance of using some form of automatic device, which, if the engineer disregards signals, will of itself bring the train to a stop. The system is perfectly feasible, as is shown by the fact that it is in use both on the subway system in this city and on the Hudson and Manhattan tunnels beneath the Hudson River. On several occasions these stops have been called into requisition, and, as far as we know, they have never failed to do their work.

Center-door Stepless Cars.—The success of the stepless car on the street railways of New York has led to the placing of an order for 150 of this type. This car was recently illustrated in the SCIENTIFIC AMERICAN, and its advantages, as stated by the president of the Street Railway Company, are: Less danger in boarding and leaving cars, less interference of entering and leaving passengers, improved seating and aisle arrangement, movements of a greater number of cars, due to the reduction of the length by removal of car steps, and improvements in the working conditions for the conductors and motormen.

Ice Dangers on the Hudson Bay Route.—If the Hudson Bay route for carrying the grain of the Northwestern Canadian provinces to Europe is established, it will be necessary to give special attention to the construction of the ships which are to be employed. In that far northern latitude, the danger of collision with ice will ever be present, at least during the months in which the ice is moving to the south. The loss of the "Titanic," a ship which was built to the highest requirements of Lloyds' construction for passenger vessels, proves that any ship which is liable to encounter ice, should be built with special view to resisting the effects of heavy collision.

Submarine in Two Hundred Feet of Water.—In testing submarines it is customary to sink them to a maximum depth and expose them to great pressures with a view to determining their stiffness and watertightness. Usually, these tests are made without any of the crew aboard. Recently, however, in a test made of the new submarine "Carp" at San Francisco, the vessel was sunk to 200 feet, with a crew of eight men aboard. The service was voluntary and a considerable bonus was offered. On account of an anchor chain fouling the hawse pipe of the submarine, the craft was unable to rise to the surface and was held at the bottom for over an hour's time. Ultimately they released their ship and came to the surface without damage to ship or men. During the dilemma of the vessel telephone communication was maintained with the officials in charge of the test at the surface.

Electricity

Transmission of Letters by Wireless Telegraphy.—A German company has recently inaugurated a service which enables the ocean traveler to get letters into the outgoing mails of his port of destination before he himself reaches land. For example, if the passenger is on a steamship bound from Lisbon to Rio Janeiro, and when a few days out wishes to send a letter to some part of Europe, he hands the communication to the wireless operator of his ship, who calls the operator of a vessel bound for Lisbon and transmits the message to him to be transcribed and mailed at that port. The letter thus reaches its destination at least a fortnight earlier than if the writer had mailed it at Rio.

Soldering Aluminium by a New Aluminium Alloy.—An English method of soldering aluminium, having special application to electrical conductors of this metal, is claimed to produce a permanent contact and to withstand the most searching atmospheric and chemical tests. Recognizing that many attempts made hitherto have failed by reason of the oxide of aluminium that creeps under the coating of solder and destroys the contact, the new method employs a solder composed of an alloy of aluminium and the necessary flux, and is applied in the form of a paste. The heat of an alcohol lamp or gasoline blow-torch, or the acetylene-oxygen welding flame (for large work), causes the solder to run freely into the joint; and in connecting heavy stranded aluminium cables a special method is employed whereby molten aluminium is poured into the joint.

Hydro-electric Power in the United States.—In a recent report of the Commissioner of Corporations it is noted that out of the 30,000,000 horse-power utilized in industrial and public utility enterprises, 6,000,000 horse-power is now developed by water, and that several millions more horse-power could profitably be developed from the same inexhaustible source. At a conservative estimate, this saves 33,000,000 tons of coal per year. Out of the 6,000,000 horse-power now developed, 3,270,755 is power generated for sale (that is, not for private use, as in manufacturing) by companies or groups of interests having 50,000 horse-power or more actually developed or under construction. The report concludes that it is not feasible to regulate the price of water power by itself, but rather to control the sites or the use of the sites.

Heat Storage Electric Stove.—A method of economizing electrical energy employed for domestic heating or cooking is to receive the energy continuously at a low rate in a resistance apparatus which transforms it into heat and then stores the heat for use as needed. In a new electric cooking apparatus operating in this way the heating unit, consuming 500 watts total or 12,000 watt-hours per day of 24 hours, serves to keep a mass of cast iron hot enough to cook food in ordinary utensils placed in contact with it. The cast iron block is thermally insulated by being inclosed in a surrounding wall of lampblack or powdered silica, and a movable block is arranged to be raised above the main mass, so as to expose its upper surface when cooking is to be done. The small current consumption, less than that of an electric flatiron, enables the device to be operated on the ordinary electric light wiring of the house.

Petroleum-electric Trunk Line Locomotive.—The internal combustion engine has often been proposed for hauling railroad trains, on account of its high efficiency as compared with steam. But the impossibility of accelerating the train from standstill with an engine of normal size, and of maintaining any considerable overload at any speed, have stood in the way of this application. A petroleum-electric locomotive is now proposed, in which the prime mover is an internal combustion engine kept continuously running to drive an electric generator, which in turn delivers electrical energy to four 220 horse-power polyphase motors. This locomotive is stated to operate on ordinary crude residue oil costing about four cents per gallon and to deliver a drawbar pull of ten to twelve tons with an electric power transmission efficiency of 88 per cent, and to be capable of hauling the heaviest and speediest trains at about half the cost of running with steam.

Locked Disconnecting Switch of High Voltages.—The ordinary disconnecting switches employed in electric power generating stations consist of a long knife switch with a single blade, mounted with highly insulated contacts. Serious faults of this device are the ease with which a destructive arc may be started by careless opening of the switch under a heavy load, and the resistance in the contacts with the blade which wastes energy continuously. In a new 2,200-volt, 2,000-ampere lock type switch having several blades the accidental or ill-considered opening of the switch is prevented and the actual current carrying capacity is increased by locking the contact cheeks into close and firm contact with the blades at the free ends of same. The locking is accomplished by hooking the ordinary switch-handle into the eyebolt of the switch and giving the eyebolt a single turn. When unlocked, a light pull on the eyebolt serves to open the switch.

Aeronautics

A Naval Aeroplane for Germany.—Germany is about to experiment with the naval aeroplane. The success of the Curtiss hydro-aeroplane at Monaco seems to have prompted this decision. An order has been placed with Curtiss for one of his machines by Kober, the directing engineer of the Zeppelin Company. The order calls for a passenger-carrying machine of the latest type, similar to that displayed at the Aero Show at New York recently. The machine is to have a 75 horse-power Curtiss engine, dual control and a single float. It is to be delivered at the Zeppelin works on Lake Constance.

A Double Flight Across the English Channel.—On May 21st Albert Crombez, a Belgian aviator, flew in a Deperdussin monoplane from Nieuport-les-Bains to Dover and back to Belgium, without stopping, covering the distance of one hundred and fifty miles in one hundred and forty minutes. At Dover he dropped a message, sending greetings to England. This is one of the most remarkable oversea flights ever accomplished. On the same day Gustav Hamel, with Miss Trehawke Davies, flew from Paris to Eastchurch, Isle of Sheppey, in a Blériot monoplane. They landed three times *en route*. This is the fourth time that the pair have flown the Channel together.

Bomb-dropping in France.—The French officers are experimenting with dropping bombs from aeroplanes, and find that this is more difficult than may be at first supposed. The object is to drop bombs of 15 pounds weight from a height of 600 feet and to place them in a target of 60 feet diameter. Lieut. Mailfert piloted the aeroplane on one occasion, with Capt. Conade attending to the bombs. Another aeroplane was piloted by Lieut. Bousquet who also operated the dropping device placed under his seat. The weather was somewhat rough, and they found that a slight wind gust was enough to send the bomb off the target. For instance, Lieut. Mailfert, who according to the regulations was obliged to drop 15 bombs in 50 minutes, took 38 minutes 11 seconds to pass 15 times over the target at 600 to 750 feet height, but he rarely succeeded in placing the bombs in the target, this being only two or three times. From this it will be seen that the matter will require considerable practice, but as these are among the first experiments there is no doubt that the future will see much closer work.

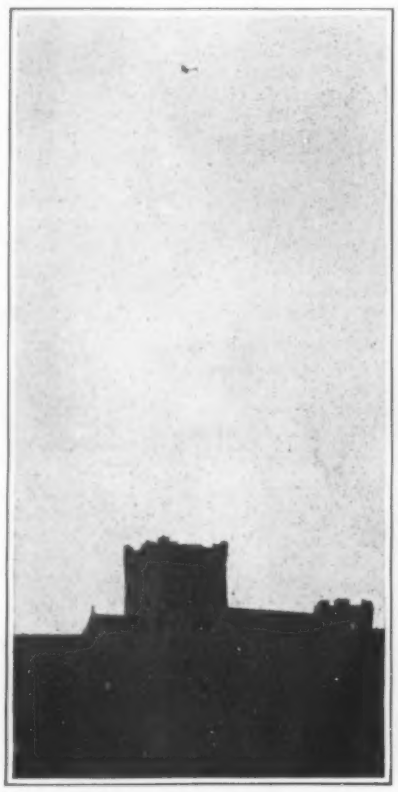
Recent Trial Flights in the American Army.—Lieut.-Col. Charles B. Winder, of the Ohio National Guard, and the first militia officer to take advantage of the War Department's offer to teach the militia officers to fly, made his first flight in a Curtiss biplane May 20th. He will soon receive his pilot's license. A. L. Welsh is demonstrating the war biplane built by the Wright brothers for the Signal Corps, at College Park, Maryland. On the afternoon of May 21st, the machine was subjected to two of the ten tests which it must withstand before the Government will purchase it. It is one of the conditions that the biplane shall fly not less than forty-five miles an hour, with four hundred and fifty pounds on board, not including gasoline, oil and water, for four hours. On the test referred to, it made an average of fifty-two and four-fifths miles an hour. The second test consisted in climbing two thousand feet with the same load in ten minutes, but in this the biplane failed. It climbed to one thousand six hundred feet in twelve minutes. A stiff wind blowing at an altitude of one hundred to one thousand feet made the climbing harder than under ordinary conditions.

The Pekin-Paris Conditions.—The rules have just been published for the Pekin-Paris aeroplane event, which the Matin, daily journal of Paris, the Matin, organized with prizes amounting to $21,000. At a meeting of the Aero Club commission, the following rules for the contest were passed. It is intended to give the event the character of a raid across China, Siberia and Europe. The pilots may be of any nationality, but French aeroplanes must be used. The start takes place from Pekin on September 1st, 1912, and the pilots will be classed in the order of arrival at Paris, the distance being about 7,800 miles. For the winner, the prize is $20,000, and there are four other prizes, one of $5,000 and three of $2,000, so that the first five comers will receive prizes. Should none of the pilots make the whole run, the sum of $10,000 will be awarded to the aeronaut who makes the greatest distance under certain conditions. At least five engagements must come in before the 16th of June in order that the event shall take place. Control stations will be organized at Pekin, Irkoutsk, on Lake Baikal, Omsk, and other points in Asia, then at Moscow, Warsaw, Vienna, Trieste, Genoa, Avignon, Dijon, Paris. Repairs can be made *en route*, and the different parts of the aeroplane are stamped officially at the start, such as motor, rudder, etc., but at least two of these parts must remain in place at the finish. The rules allow for one pilot making the whole race, two pilots for the same, or two pilots, one of whom makes half the course alone. In all cases these pilots cannot be replaced by others. It is intended to have the race occur across different countries in Europe, including Russia, passing southward through Austria and Italy, then mounting again through France.

The Crossing of the English Channel by an American Aviatress

BESIDES being the first American woman to procure a pilot's license, Miss Harriet Quimby recently gained fame by being the first aviatress to fly across the English Channel. A number of women flyers have planned to make this trip at one time or another, but none have actually accomplished it, or even, for that matter, made a start. Miss Quimby decided to make this flight some months ago, and early in March she took a special trip abroad for the purpose. In a fifty horse-power Gnome-engined Blériot she started at 4 A. M. on April 16th from Dover. Describing a large circle, she passed over Dover Castle as shown in our illustration, and in five minutes she was lost to view far out over the Channel. Steering by a tug which was awaiting her in mid-channel, she rose to 3,000 feet. She continued climbing for several minutes more until she was at twice this height. Soon after passing the tug she plunged into a dense fog and was obliged to steer by compass. Despite some motor trouble she landed at Hardelot, near Calais. She was greeted by the fishermen and life-savers and carried in triumph to the life-saving station by some friends. She was treated with great consideration and, as a reward for her flight, was presented with a large old China tea cup from which she had been sipping a warming drink; for although she wore three coats and furs, traveling 60 miles an hour through dense fog she found very chilling.

The flight across the Channel was made in a straight line, the 22 miles being covered in 20 minutes. The total time from the start until a landing was made at Hardelot was about 40 minutes.



Over Dover Castle at the start.

Miss Quimby in her flying costume.

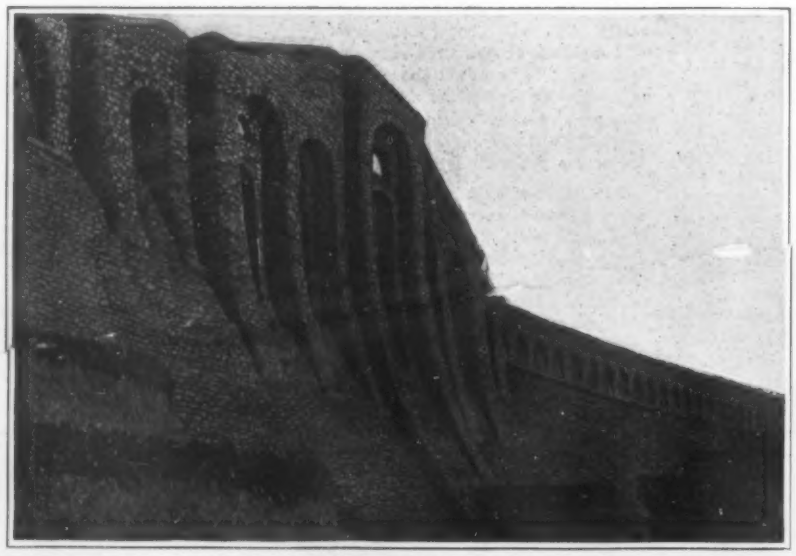
Miss Quimby's reception at Hardelot.

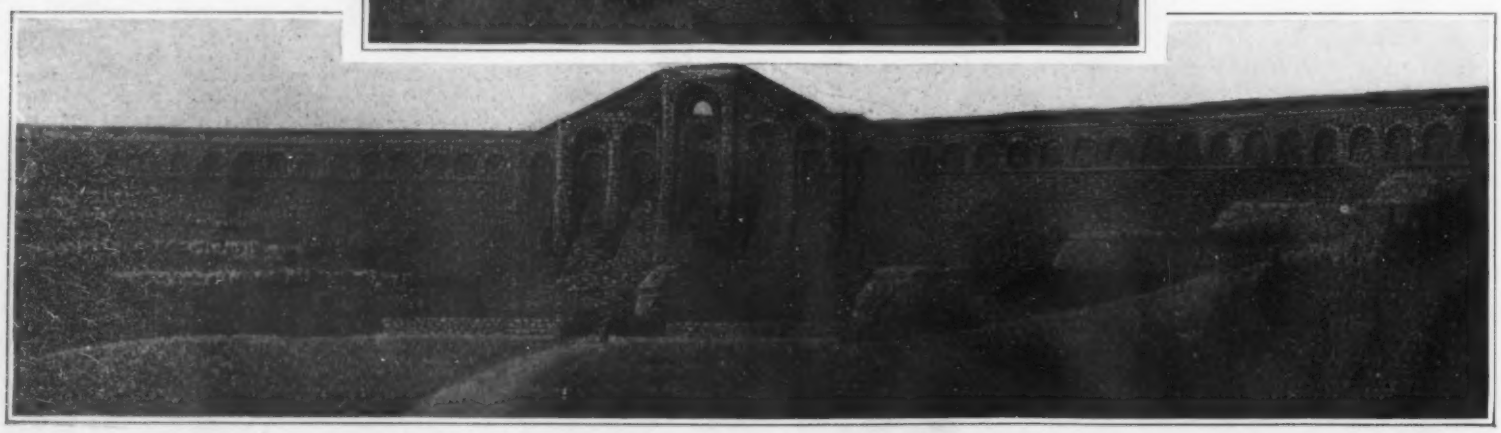
The Klingenberg Dam in Saxony

By Robert Grimshaw

THE illustrations of the Klingenberg dam present a good example of a case which occurs but too rarely—the gift of architectural character, dignity, originality, and beauty to so "homely" construction as that of a dam. The object represented is a dam across the valley in the kingdom of Saxony, and the architect who has clothed the engineers' ideas so worthily is Prof. Hans Poelzig of Breslau, a pupil of Schäfer, and that says a great deal; in particular that the main thing is not only to ornament structure or design but to make the general character at once structural, ornamental, and appropriate—which means to be logical. Poelzig considers the formal mannerism as an asses' bridge and avoids it in all his work; for instance, in building a water tower, he divides and supports the lower masonry by buttresses, as the natural and characteristic solution of the problem, to combine beauty and strength; and he seeks his beauty in proportion.

This dam over the "Wild Weisseritz"—a stream which has given so much trouble in past years, particularly in 1897, when it caused about $3,000,000 direct damage—is being constructed as rapidly as possible. About 500 workmen are now engaged. The surface material of earth and rock has been removed to a depth of about 26 feet by bucket excavators of 45 horse-power each, taking 70 cubic feet at a load. The necessary stone, which is gneiss, is obtained from an adjacent quarry; about 120,000 cubic meters (156,954 cubic yards) will be needed. The dam will be 315 meters (1,033.5 feet) long, 40 meters (131.2 feet) high, 34.7 meters (113.8 feet) thick at the base, with a mantle 80 centimeters or 31.5 inches thick; 5.5 meters (18.04 feet) thick at the top; or, reckoning the apron and capping, 7.3 meters (23.95 feet). Upstream there is a paved high-water dam, along the foot of which the river flows. The work should be completed in 1913. The impounded water will reach about 4 kilometers (2.48 miles) back from the dam. The supply is figured at 100 liters (26.42 U. S. gallons) per second for drinking purposes, and 900 liters (237.8 gallons) for power.





Face view of the Klingenberg dam, and the terraces and paths at the foot of the approach.

De Quervain's Expedition Across Greenland

DETAILED plans of this expedition (see SCIENTIFIC AMERICAN, February 3rd, 1912) indicate that it will be especially noteworthy on the meteorological side. Three members of the party, Prof. Mercanton, Dr. Stolberg, and Dr. Jost, will remain on the west coast, at Disco Bay, to make glaciological and upper air observations. The rest of the party, Dr. de Quervain, Dr. Hoessli, R. Gaule, and R. Fick, after crossing Greenland, will sound the upper air on the east coast. Meanwhile, Capt. Koch's Danish expedition, which includes the well-known German meteorologist, Dr. Alfred Wegener, will have landed at Cape Bismarck, on the coast farther north, preparatory to crossing Greenland at its widest part in 1912-13, and will also make soundings of the upper air. Finally, arrangements have been made whereby similar observations will be made at the same time at the German meteorological station in Spitzbergen. The records from these four points of both surface and upper air conditions will constitute a body of meteorological data unique in the history of polar exploration.

The effect of the explosion.

Lead cylinder used in the tests.

Placing the cartridge.

A New Safety Explosive

Resistant to All Shocks and Temperature Conditions

ALMOST interesting series of tests of a new explosive was conducted on Wednesday, May 15th, at the site of the new reservoir near Valhalla, N. Y. The material, which is protected by a patent issued to the inventor, the Marquis Roberto Imperiali, consists essentially of a mixture of ammonium nitrate (80 parts by weight), potassium nitrate (5 parts by weight) and aluminium powder (15 parts by weight), to which may be added a suitable bonding agent. As such, a mixture of mononitrotoluol, glycerine and collodion to which a small quantity of potassium permanganate may be added, is suggested. The new explosive has been named "imperialite" after its inventor.

The new explosive possesses some exceedingly remarkable properties, chief among which is, perhaps, its extraordinarily high resistance to all kinds of influences, such as with most other esplosives would lead to disastrous results; thus, for example, the powder can be heated quite safely up to some 900 deg. Fahr. without any explosion. It simply undergoes partial sublimation, without any other violent change. The material can also be hammered and subjected to any kind of shock without the slightest fear of accident. This was demonstrated to the audience which attended the test, both a cartridge of the material and also some open powder being subjected to hammer blows without any explosion resulting. It should be remembered that dynamite, for example, is apt to explode under shock, especially when frozen, and that many serious accidents have occurred through this cause.

To give an indication of the blasting properties of the new compound, a number of charges of imperialite and of other explosives, by way of comparison, were fired in heavy lead cylinders, one of which is shown in near view in our illustration. This cylinder had a hole bored in it, of a volume 67 cubic centimeters, this hole being closed during the test by means of a metal plug which was fastened down, as shown in the illustration, by means of a cross bar and bolts.

The following results were obtained and may serve to show the blasting properties of imperalite as compared with those of common blasting materials. Fifteen-gramme samples were used. The first test was performed with imperialite, and the cavity formed in the lead cylinder was measured by means of water poured into it. It was found to be 780 cubic centimeters. In a later test, performed under similar circumstances, the corresponding figure was 862. Compared with this the following figures were obtained with other materials: 40 per cent DuPont forcite, 557 cubic centimeters; 60 per cent DuPont forcite, 645 cubic centimeters; another sample of the 60 per cent DuPont forcite, 655 cubic centimeters; picric acid (melinite) 620 cubic centimeters.

From all of these figures the original volume of the hole, measuring 67 cubic centimeters, as mentioned above, should be deducted to obtain a proper comparison.

It will be observed that, so far as these tests show, imperialite easily leads among the materials selected. The explosion is exceedingly sudden and the material is calculated for blasting purposes and not for the propulsion of projectiles, in the present state of development.

In conclusion a rather spectacular test was made. A large piece of rock was selected, for the blasting of which it had been estimated that about 1,200 grammes of dynamite would be required. A charge of 800 grammes of imperialite was placed in this and fired. In one of our illustrations the inventor is seen in the act of placing the cartridges in this rock. The other engraving shows the rock after the explosion. It will be seen that the thoroughness with which imperialite did its work leaves nothing to be desired.

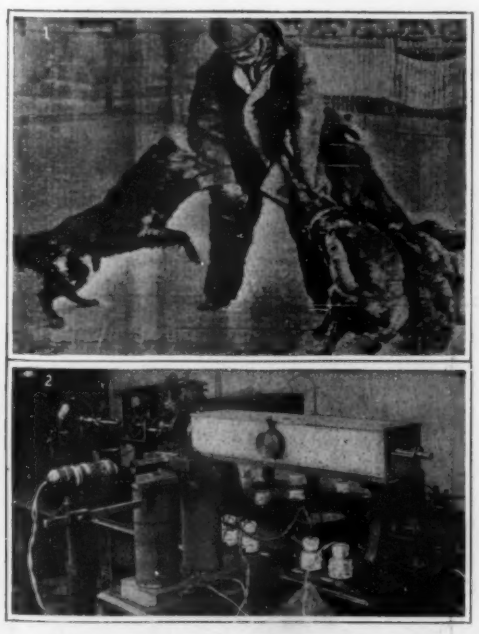
As regards the cost of the new explosive, estimating ammonium nitrate at 7½ cents per pound, and potassium nitrate at 5 cents, aluminium at 20 cents, the total cost of the material of which the powder is made figures out to from 8 to 9 cents per pound.

The Transmission of Photographs Over Telephone Wires

By the Paris Correspondent of the Scientific American

IN France transmission of photographs over a telephone wire is now beginning to take a practical shape for journalistic work, and views of this kind now appear in the Paris papers. *L'Illustration* is taking the lead, and a station is installed at Paris which is working with a second one at Monte Carlo. Some years ago it took up the question, when Dr. Korn brought out his photograph transmitting apparatus, and this led to placing a laboratory at the journal's office, to work with Berlin and London. Later the station at Monte Carlo commenced to operate, but as a result it was found that there was much difficulty in sending the pictures over the wire by Dr. Korn's first method, which was based on the use of selenium. We described this apparatus at the time. In view of these difficulties on the line, Dr. Korn recently devised another form of apparatus which we illustrate here. Inasmuch as an apparatus based on the use of selenium will only allow of a very small current on the line, he made a device which would carry a much larger current for the line, so as to modify the disturbances. This now allows of obtaining a fairly good transmission of the pictures.

The method used is the following: Photographs are taken in the afternoon at Monte Carlo, and quickly developed in the laboratory. Copper plates are prepared with the image upon them so that they can be put into the apparatus and run over by an electrical contact point so that the current is made or broken according to the light and dark places of the picture. These currents are received at the Paris end and are used in a photographic recorder upon a film wrapped around a cylinder, so that a negative is the result. At Monte Carlo, a copper film is prepared by direct photographic printing from the negative, and by using a suitable method resembling that used for half-tones, the copper plate is



1. Picture of police dogs of Monte Carlo, received at Paris. 2. View of apparatus with the photograph box in actual position. On the front of the box is the pinhole for light. 3. Photograph of hydro-aeroplane flight of Aviator Fischer and Lieut.-Col. Estienne, transmitted from Monte Carlo to Paris. 4. Receiver and photograph film lamp, electric magnetic shutter, photograph box and cover lid, cylinder and its film. Motor and transmitter in the rear. 5. View of a hydro-aeroplane event at Monte Carlo, sent to Paris.

TRANSMISSION OF PHOTOGRAPHS OVER TELEPHONE WIRES

covered with narrow parallel lines of insulating substance, very thin in the white parts and broad in the blacks, like a half-tone, except that lines are used instead of dots to make the picture. The copper film is made entirely by the photographic method and takes but a short time.

It is now ready to be put in the instrument, and is wrapped around a metal cylinder about like a phonograph cylinder, and against it bears a small metal point. As the cylinder turns, the point runs across the lines of the image, and in the whites represented by the bare copper it makes a contact so as to send current in the line. In the blacks which are formed by the insulating coating the current is cut off, according to the well-known method. At the Paris end the operator has wrapped a photographic film around a cylinder contained in a dark box, and the image is made upon the film by a small spot of light controlled by an electro-magnetic shutter working by the line current. The operator removes the film and develops it, and after a quick washing and drying it is sent to the journal to have a half-tone made. The operators at Monte Carlo prepare the plates toward evening and wire the picture during the night for the morning papers.

Our engravings represent the new apparatus, and we were able to secure the present views by the courtesy of M. Carazzolo, the engineer who operates the Paris end. An electric motor runs at constant speed and drives the two separate parts of the device, first the transmitter and second the receiver. This latter is a modified form of Dr. Korn's first photographic receiver. A Nernst lamp sends a small and powerful beam of light through the electromagnetic shutter and thence upon the small pinhole in the box so that it falls upon the film. The shutter consists of a light metal strip stretched across the beam and acted upon by an electromagnet. This latter is kept charged by a storage battery so as to set up a strong permanent field. When no current is passing in the metal strip there is no action and the light is now cut off from the film, but when current passes in the strip coming from the line, the strip moves off the beam and light enters the box. Over the 550 miles there is a considerable disturbance on the line, and this is felt in the resulting picture. On the other hand, the current sent by the instrument cannot be increased beyond a certain point in order to overcome the line effects, as this would mean an undue sparking on the copper film where the contact is made.

At Paris the copper films are prepared by M. Chatenet in a special photo-engraving laboratory, and there is another of the same kind at the Riviera end. A double telephone wire is used for the line.

Devouring a Hundred Tons of Mud per Minute

The United States Suction Dredge "New Orleans"

ALTHOUGH the Mississippi River has done and is still doing excellent reclamation work in the Gulf of Mexico, having in the course of its history added something like 1,200 square miles of land to the continent, it is not at all considerate in the matter of keeping its own channels clear. The land-building instinct of the river must constantly be kept in check by dredging. The United States Corps of Engineers of the War Department, which has the task of keeping the delta open to navigation, has recently put into service on the Southwest Pass a suction dredge of novel type. This dredge is provided with a suction head of the Fruhling type, a type that has been successfully employed in Europe and Canada where dredging conditions are similar to those of the Mississippi passes.

As shown in the insert on our front page illustration, the head is practically a huge inclosed rake, some eighteen feet wide by five feet fore and aft. Through the sharp cutting teeth of this rake water is ejected at a high pressure to disintegrate the soil and make it of suitable consistency to be sucked through a pair of suction pipes into the pump, from which it is deposited in any of ten hoppers carried by the dredge. These hoppers have a combined capacity of 3,027 cubic yards, or approximately 3,000 tons, and under favorable conditions they may be filled in the remarkably short space of thirty minutes. The dredge may then be run to the dumping ground at a speed of ten knots. Here the hopper doors, twenty in number, which open outwardly through the ship's bottom, may be operated by four hydraulic ram mechanisms, either individually or simultaneously, to discharge the load. In order to make use of the material for reclamation work a swivel deck pipe has been installed, to which the necessary lengths of shore piping may be coupled, and through this pipe the dredge can discharge her cargo by sucking it from the hopper and ejecting it to any location desired. The swivel pipe may also be used for discharging into scows or other hoppers alongside.

In order to operate the dredge at its fullest capacity, the suction head must be kept at a certain depth; otherwise it would tend to dig so deeply into the bottom as to clog the head or even anchor the vessel. As automatic regulation of the depth is impracticable, the adjustment of the suction head has been placed under the control of an operator. It is suspended from the stern of the ship by wire ropes. Two ropes are used, each made fast to the ship at one end. The ropes run under sheaves on the cutter head and then over sheaves on the stern of the boat to the drums of a winch. Between the stern sheave and the winch, the ropes pass over the sheaves of an equalizer device, which keeps the tension the same on each of them. The central winch may be operated to regulate the depth of cut with practically no physical exertion, permitting the operator to change the position of the cutter from moment to moment as required, and to raise or lower the heavy head and suction pipe as he pleases. This mechanism is of the same type as that used for steering purposes on small boats. It was built by the Lidgerwood Manufacturing Company, who have supplied this form of steering mechanism for United States torpedo-boat destroyers. The operator needs merely to turn the control wheel of the engine, while the drums follow closely the movement of the wheel and hold the weight of the head and suction pipe at any point where the wheel is left at rest. The engines have a lifting power of 40,000 pounds, that is, 20,000 pounds on each drum, and they hoist at a speed of 50 feet per minute.

The dredge has an over-all length of 315 feet, and its molded breadth is 50 feet, while its molded depth is 26 feet. The draft of the dredge when loaded is 20 feet and it will dredge to a maximum depth of 50 feet, and minimum depth of 21 feet. The machinery of the vessel consists of four sets of triple-expansion, inverted, marine-type engines, arranged in pairs, tandem and built on a common bedplate. The two after sets of engines are coupled to the propeller shafting and the two forward sets to the 26-inch centrifugal pumps used for dredging. If desired the propelling and pumping engine may be coupled together, so that the full power of all four engines can be used on the twin propellers to drive the dredge. The dredge was built at the Fore River Shipbuilding Yards, Quincy, Mass.

The Panama Hat Palm

THERE is no more important plant in the chandelier-tree family (*Cyclanthaceae*) than the hat-palm (*Carludovica palmata* R. & P.), although it is not well known to the botanical world. From its leaves is obtained the material known in the trade as cogollo, which is used so extensively in Panama, Colombia, Venezuela, Guiana, Ecuador, Peru, and other parts of Central and South America for making the famous Jipajipa or Panama hats. Not all, however, comes into commerce under the name of cogollo. In Panama and Costa Rica it is called chidra or palma de sombrero, which is the Spanish for hat palm, and in Venezuela it is known as palma de cogollo or palma lucateva.

This plant is found growing wild in enormous quantities, and is largely exported from Venezuela to the island of Curaçao, where the hat-making industry is carried on to a considerable extent. Hat making is an ancient industry among the Indians of Central America, but at present only those in the very remote settlements are engaged in this work. The natives of Pacaca, Nicoya, and in the valley of Piquis, are still gathering the leaves of this plant and manufacture them into hats for market. By far the greater number of high-grade Panama hats are now made in Manta, Monti, Christi, and other parts of Ecuador. A good many are made also in Peru. As early as 1860 over 12,000 dozen of these well-known hats, valued at $300,000, were exported from Catacaos, Peru.

These hats are worn extensively in America and would, probably, be used equally as much in Europe were they not so high priced, amounting often to $150 for a single hat. In Peru and Ecuador the Indians manufacture from the leaves of this plant, besides hats, beautiful cigar cases, which fetch sometimes more than $30 apiece. Cogollo is utilized also for making baskets, table mats, bonnets, and numerous other fancy articles. Sometimes baskets are made of these palm leaves which are woven so tightly as to serve the purpose of buckets for carrying water.

The plaiting of the hats is done on a block, which is placed upon the knees. According to the quality of the hats, more or less time is occupied in their completion; the coarse ones may be finished in two or three days, the finest take as many months. The best times for plaiting are the morning hours and the rainy season, when the air is moist. In the middle of the day and in dry clear weather, the straw is apt to break, which diminishes the value of the hats. Panama hats are distinguished from all others by their lightness and flexibility and in that they consist of only a single piece. They may be rolled up and put in the pocket without injury. During rainy seasons they are apt to turn black, but by washing them with soap and water, be-smearing them with lime juice, and exposing them to the sun, their whiteness is easily restored.

The straw tufts obtained from this plant have to go through several processes previous to plaiting. The young and tender leaves are gathered before they unfold, care being taken not to injure the terminal buds, as otherwise the plants would die. All the ribs and coarse veins are then removed, and the rest, without being separated from the base of the leaf, is reduced to shreds. The first cutting is made when the plant is one year old and, thereafter, from two to three times per year. After the leaves are gathered and reduced to shreds, they are placed in large earthenware jars from three to four feet high. These jars are then filled with water to which has been added the juice of three or four lemons, in which the leaves are allowed to soak for six to ten days in order to remove all vegetable saps and resins. After this they are spread in the sun for several days until they are bleached to a cream white. They are then made into bundles weighing about two pounds each and are ready for market. The amount and value of this fiber or straw tufts exported from the port of Maracaibo, Venezuela, for each year since 1908 is as follows:

Year.	Quantity.	Value.
1908	71,367 pounds	$3,192
1909	190,281 pounds	12,542
1910	363,940 pounds	24,165

These figures show the enormous increase in the use of this material during the last three years.

Value of hats, bonnets, and hoods composed of cogollo imported from Colombia, Ecuador, Peru, and Venezuela for each year since 1905, is as follows:

	1905.	1906.	1907.	1908.	1909.
Colombia	$68,290	$167,836	$285,408	$426,597	$286,990
Ecuador	221,731	315,288	285,552	200,080	150,366
Peru	86,909	124,922	113,325	80,902	55,688
Venezuela	3,286	365	20	3,315	14

The Digestion of a New-born Infant

THE new-born baby is quite a helpless object in many respects, but it has some resources that have not been suspected. A common belief in regard to these interesting animals is that they are quite incapable of digesting anything but the comparatively simple food of the mother's milk. It is certain, at any rate, that no one in his senses would offer such a baby food that is radically different from that of the mother's milk.

Dr Alfred F. Hess of the Department of Health of New York city has been able to show that both the stomach and the intestine of a new-born infant—one that has not yet partaken of any food—contain digestive ferments in considerable quantities. In the stomachs he found not only hydrochloric acid, as in the stomach of an adult, but the two ferments pepsin and rennet. The stomach is therefore prepared to digest from the very start. The hydrochloric acid seems to have a useful function in that it is capable of killing any bacteria that may get into the stomach by mistake.

In the intestine Dr. Hess found three types of ferments; namely, protease, or protein digesting ferment; lipase, or fat digesting ferment; and amylase, or starch digesting ferment. The last was the least regular in its amount, in some cases none being present. Although bile is known to be present in the gall bladders of embryos some time before birth, Dr. Hess was unable to find any in the upper part of the intestines of any of the thirty-five babies that he examined.

The material for chemical examination was removed from the infants by a special rubber tube, so that no harm was done to the little patients. X-rays were used to show the location from which the samples were removed.

Motor Routes in Africa

THE German colony of Kamerun, recently much enlarged by the cession of French territory, is to be connected with German East Africa by a service of motor cars crossing the Belgian Kongo. A number of German engineers are now studying the routes and planning the extensive road-making and bridge-building operations that will be necessary in order to carry out this novel project.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Problems of the Mississippi Floods

To the Editor of the SCIENTIFIC AMERICAN:

The recent disastrous floods in the Mississippi valley, caused by the failure of the levees, are now engaging public attention to an unusual degree, and considerable discussion is being indulged in as to the methods and means of repairing the broken levees and the construction of new ones to prevent future floods.

I write this to suggest that the whole system, or idea, of resorting to levees is not only wrong in principle, but impossible to carry out. To build embankments to confine the waters of the great Mississippi and its tributaries is only to postpone the evil day. Sooner or later the problem will have to be solved right, and the levee system is not the right one. The sooner this fact is recognized by the government and the people, the better it will be for all concerned. A little reflection will convince any one competent to form a correct judgment on the subject, that the foregoing statement is sound.

As the spring rains come and the snow melts in the watersheds that empty into the Mississippi, immense quantities of silt and soil are carried into the main channels of the rivers. As the current is not swift enough to carry away this soil, a large portion of it is deposited in these channels of the rivers. This deposit fills the beds of the streams, and levees are built to confine the waters to their channels. As the successive seasons send down more soil, the levees must necessarily be built higher and higher to meet the demands caused by these annual depositions. Thus the embankments must from time to time be built higher and higher, and it is plain that, following out this system, the river receiving the main deposits will in time be literally up in the air, a position impossible to maintain.

A better way to prevent such disasters as the people have suffered this spring through the Mississippi floods is to dredge the rivers and remove each year an amount of deposit equal at least to that which is brought down by the descending waters. This would be, perhaps, the cheapest effective method of disposing of the yearly accretions of soil which the streams bring into the channels of our great natural drainage systems.

A still better way, and ultimately cheaper because better, would be to allow the rivers to overflow each year from source to mouth, wherever the banks are low enough, and thus to deposit in the valleys the rich soil to replenish the exhaustion of agriculture. If any levees at all are to be made use of, each land owner should construct his own to protect his individual property. Better that he should invest the capital necessary to protect his home and live stock than to be deprived of the rich soil which the annual floods may bring to fertilize his land, and which would be lost by dredging. By abolishing the levees along the banks of the rivers the water would be distributed over such a wide area that the floods would nowhere be so excessive as to do any serious damage; and with supplemental systems of individual protection, the floods could eventually be so regulated as to be a source of profit rather than harm. Most of the prosperity of ancient Egypt was made possible by the rich soil and irrigation caused by the annual floods of the Nile. The levee system is only a makeshift, and for permanent results is, at the same time, impossible, while dredging is expensive and wasteful.

This is not intended for an "article" on the levee system, but merely to call attention to a subject of vital interest to a large section of our country, and one which from an engineering standpoint I deem of interest to you.

Springfield, Mo. H. H. HUGHES.

Comment on the Forest Bill

To the Editor of the SCIENTIFIC AMERICAN:

I notice in your paper, on page 302 of No. 14, of date April 6th, 1912, the article entitled "A Senseless Forest Bill."

I am thoroughly in sympathy with everything that will conserve timber and that will prevent and extinguish forest fires, and will protect the head waters of our rivers, and all of this from a selfish motive, as I am an investor in timber and in industries dependent upon water supplies. Personally, however, I do not think that the heads of the Forest Service are as much interested in the above-mentioned matters as they are in a desire for power.

I think a resentment of their usurpation of authority beyond the laws of Congress is raising the antagonism your article suggests. Something must eventually bring about a better administration going to the conservation of our resources.

The acts of Congress permit of the declaration of a forest reserve over timbered lands and the head waters of streams, but the Forest Service has from time to time had extensions made of previously declared reserves out over vast areas of desert and mountain where there is no timber and no head waters, solely, I believe, for the purpose of creating jobs and of illegally extending their power.

If there was timber in some of these extensions of any value, it had been previously patented to private parties for years.

These extensions over barren, treeless territory are traversed by forest rangers, apparently imbued with the sole idea of "riding" the sheep, cattle, and other industries therein, and principally the men who drive their stock across this country, or who have previously owned for years patented land around the water therein. In this way they make a part of their salary, while the rest comes out of the general government.

My point is this: That these men should be in the timber where there may be fires, being there to prevent or put them out if they occur. Therefore, if you withdraw these rangers from these areas of barren mountain and desert, and concentrate them over the really timbered land, you will find quite a difference in your figures.

I know your desires so far as conservation is concerned are of the best, and you are absolutely fair in your arguments; but although I have the same desires as yourselves, still I think much money is now being unlawfully diverted and should be curbed, and wish you would interest yourselves in the matter further.

If you want specific instances I will furnish them.

San Francisco, Cal. W. H. METSON.

Drainage of the Mississippi Valley

To the Editor of the SCIENTIFIC AMERICAN:

Anent "Government Railroad in Alaska," in your issue of April 13th, page 325, I beg to suggest with regard to the question of government drainage of the Mississippi valley, that no better use could be made of the machinery which will be out of commission when the Panama canal is completed than to move it to the United States and reclaim seventy million acres of swamp lands along the Mississippi River.

First. There is more good to accrue to both people and government by this drainage project than could possibly result from an Alaskan railroad. The health of the people in this belt would be protected. The value of the reclaimed lands would be about equal to that of the fertile valley of the Nile.

Second. Government owes it to the people. For years millions have been pouring in a constant stream toward the arid western deserts. Why not reclaim land ten times as good and ten times as accessible?

Third. Not only should the Mississippi valley be drained, but a canal, deep and strong, should be dug and the river turned into that. R. J. KELLY.

Ruskin, Tenn.

Gyroscopic Action in Aeroplanes

To the Editor of the SCIENTIFIC AMERICAN:

I have been much interested in reading a letter, published in your issue of February 10th, by S. S. Jerwan, on "The Steering of Aeroplanes." While the statements he makes with regard to the steering itself are correct, the reasons he gives I cannot agree with.

Gyroscopic action is often misunderstood, and to it are often attributed actions that it was not at all responsible for. Gyroscopic action can only exist where there is revolution about one axis and then attempt is made to revolve it about another axis perpendicular to the first. In this case the gyroscope resists this second attempt, and instead revolves about another axis perpendicular to the other two.

In an aeroplane, running in a straight line, we have the propeller and fly-wheel revolving about one axis. Unless effort is made to revolve them about some other axis, no gyroscopic action can be set up. This is true whether on the ground or in the air, so long as no change of direction is made. Therefore, gyroscopic action, not being in existence, cannot explain the tendency of a machine to turn to the left when running in a straight line.

That a machine with one propeller does tend to turn is perfectly true, but this is due to one of the fundamental laws of mechanics, that of action and reaction being equal and opposite, not to gyroscopic action.

When the propeller is made to revolve, power is exerted, and this power must react on something. The only thing there is to react on is the aeroplane. Hence if such a machine were suspended in space, both propeller and aeroplane would revolve in opposite directions, and with speed proportional to the inverse ratio of their moments of inertia.

Now, to overcome this tendency of the aeroplane to revolve, the left wing is warped down and the right wing up, thus increasing the lift on the left side and decreasing the lift on the right. This holds the machine even, but when the left wing is down and the right up the resistance on the left side is greater than that on the right, so the machine tends to turn to the left, and to prevent this the rudder must be turned to the right. This tendency to turn is simply a matter of action and reaction and has nothing to do with gyroscopic action.

Mr. Jerwan's statement as to the tendency to turn down when turning to the left and up when turning to the right is gyroscopic action. There we have the fly-wheel revolving about one axis, and then an effort is made to turn the machine about another axis, perpendicular to that one. This creates the gyroscopic action, which tends to turn the machine up or down.

As gyroscopic action depends upon the moment of inertia, I doubt if the propeller alone has any appreciable effect on the machine. A propeller has its principal mass near the axis and little at the extremity, so its moment of inertia will be low, but a fly-wheel is designed for high moment of inertia. That is its sole valuable quality. Therefore, I doubt that there is any great difference in gyroscopic action between machines having one propeller and those having two propellers, if they both have either rotary engines or engines with large fly-wheels. F. E. HUMPHREYS.

New York.

Diseases of Aluminium

To the Editor of the SCIENTIFIC AMERICAN:

About a month ago the writer called your attention to a translated article illustrated in the *Literary Digest* on the subject of "A Disease of Aluminium." Since that time he has had the opportunity of examining a circular piece of hard-rolled aluminium ⅛ inch thick and about 10 inches in diameter that, attached in a horizontal position by aluminium pins to the top of a marble shaft, and elevated 3 feet above the ground, has been exposed on the outskirts of Baltimore to the action of the elements for two and one half years. This was in the open and not subject to the drippings from trees, etc. When this metal was placed in position it was smooth and highly polished. On examination I find it irregularly covered with patches of a sort of "black rust," scattered in much the same general manner as would take place with the iron rust formed on a sheet of unpainted tin plate exposed to the weather, the water working through to the iron in irregular patches and granulations with comparatively bright spaces between. But worse still are a series of black lines, having the appearance of cracks with raised edges, all running in one direction, evidently the direction in which the plate passed through the rollers in rolling it out.

These cracks or fissures, while not very deep, are yet sufficiently deep to seriously impair, together with the scattered granular corrosion, the plate both in appearance and for practical purposes; and if this continues at the same rate that it has during the past two and a half years, it is only a question of a comparatively few years when the plate will be, for all practical purposes, destroyed. The writer had made use of aluminium for this purpose, using the best commercial grade obtainable, for the reason that the general claim had been made for this metal that it would not form oxide to any extent, and that it would not corrode, but remain in bright and pleasing condition indefinitely. That aluminium kept dry will hold its bright surface for an indefinite period is probably true. As to the cause of this very serious trouble with aluminium, the authors of the article previously referred to, after much experimentation, attributed it to electrolysis, due to strained conditions being set up in the fibers of the metal during rolling, resulting in poles being formed in limited areas when in contact with water, the most serious deep corrosion always taking place in parallel lines, apparently in the direction that the metal was rolled or drawn.

As the result of their experiments, the only remedy they were able to suggest was a pretty thorough annealing of the metal, this apparently preventing the more serious form of corrosion in deep lines; but as annealed aluminium is so soft as to be of very little practical use for most purposes, the remedy is about as bad as the disease.

The writer would state further that some pieces of ⅛-inch aluminium from the same lot of metal, erected at the same location, but in a vertical position, show comparatively little corrosion, and none of the deeper straight line corrosion; in this position water falling upon the metal drained off quickly and did not remain on the surface in any depth. How far chimney gases, possibly being taken up by the rain in the writer's case near a large city, may have intensified the result, he is unable to say. He is also unable to say how *cast* aluminium may behave when long exposed to the weather, but if the rolling and compression is at the bottom of the trouble, the cast metal should be little affected.

Baltimore, Md. C. L. WOOLLEY.

Fig. 1.—The four photographs obtained with the three mirrors. The last picture is a bust produced by M. Cardin.

Sculpturing With the Camera

The New Cardin and Some Old Processes

By P. F. Mottelay

MANY of our readers will be surprised to learn that the art introduced by Daguerre can do much more than has been shown in photographic channels. It not only aids the engraver, but it has now favored the sculptor as well, although, it is true, in a much more restricted manner.

The first intimation of the fact that statuary, for instance, can be produced in different sizes by photography was given in Paris by a sculptor, M. Willème, who, during 1861, proved his ability to make good clay duplicates of any animate or inanimate object exposed for the purpose in the new studio he had built in the Champs Elysées. This was generally questioned at the outset, but it did not take long to prove that this inventor's claims rested upon very satisfactory grounds. He had long worked at the problem and, as a result of his perseverance and ingenuity, reproductions of statuary and of individuals were exhibited in the show windows of the Messrs. Giroux, and the process of photo-sculpture, as he called it, was given in the columns of M. Deherain's "Annuaire Scientifique," and was thus afterward explained:

The object to be reproduced was placed in the center of a raised circular platform, divided at its base into twenty-four equal segments and of which the circumference could be included in the field of a single camera. Twenty-four different photographs were simultaneously taken, thus giving different points of view of the object. In order that these flat reproductions could be made to yield a statuette or bust, they were transferred to a lump of clay in manner following: The photographs were placed upon two upright sliding tablets fastened vertically to a mobile plate or turn-table holding the modeling clay, and use was made of the pantograph—a well-known mathematical instrument employed to copy diagrams, plans, etc., upon a premeditated scale. M. Willème's process required two assistants to manage it. One applied the tracer of the pantograph along the lines of the picture, while the other directed a cutting tool placed at the opposite end of the pantograph over the lump of clay, upon which was soon formed a counterpart of the leading photographic outlines. The photographs were numbered from one to twenty-four, the mobile plate being likewise divided into the same number of equal parts. The photographs on which the pantograph acted were those taken at an angle of ninety degrees—say, one and seven, two and eight, etc. —and whenever the tablets received fresh pictures the plate was turned one division. By this means all the contours and details of the photographs could be readily transferred to the clay and it was left to the artist only to finish off the reproduction in whatever manner desired. But, notwithstanding the fact that Willème had thus shown a new and attractive application of photography, he did not succeed, contrary to his anticipations, for the reason that the art of photography was not then far enough advanced to enable him, with the facilities then at hand, to produce within reasonable cost such work as would attract the general public. His reproductions were exact copies, but they lacked life, and his process lost favor.

Since the introduction of M. Willème's invention several others have made known discoveries much in the same line, but of these only two can claim the merit of an acceptable novelty. The first is the autoplastic method of M. Carlo Baise, an Italian, who very ingeniously obtained a correct photographic reproduction by exposing a layer of chromium gelatine to different intensities of light passing through a negative. It has

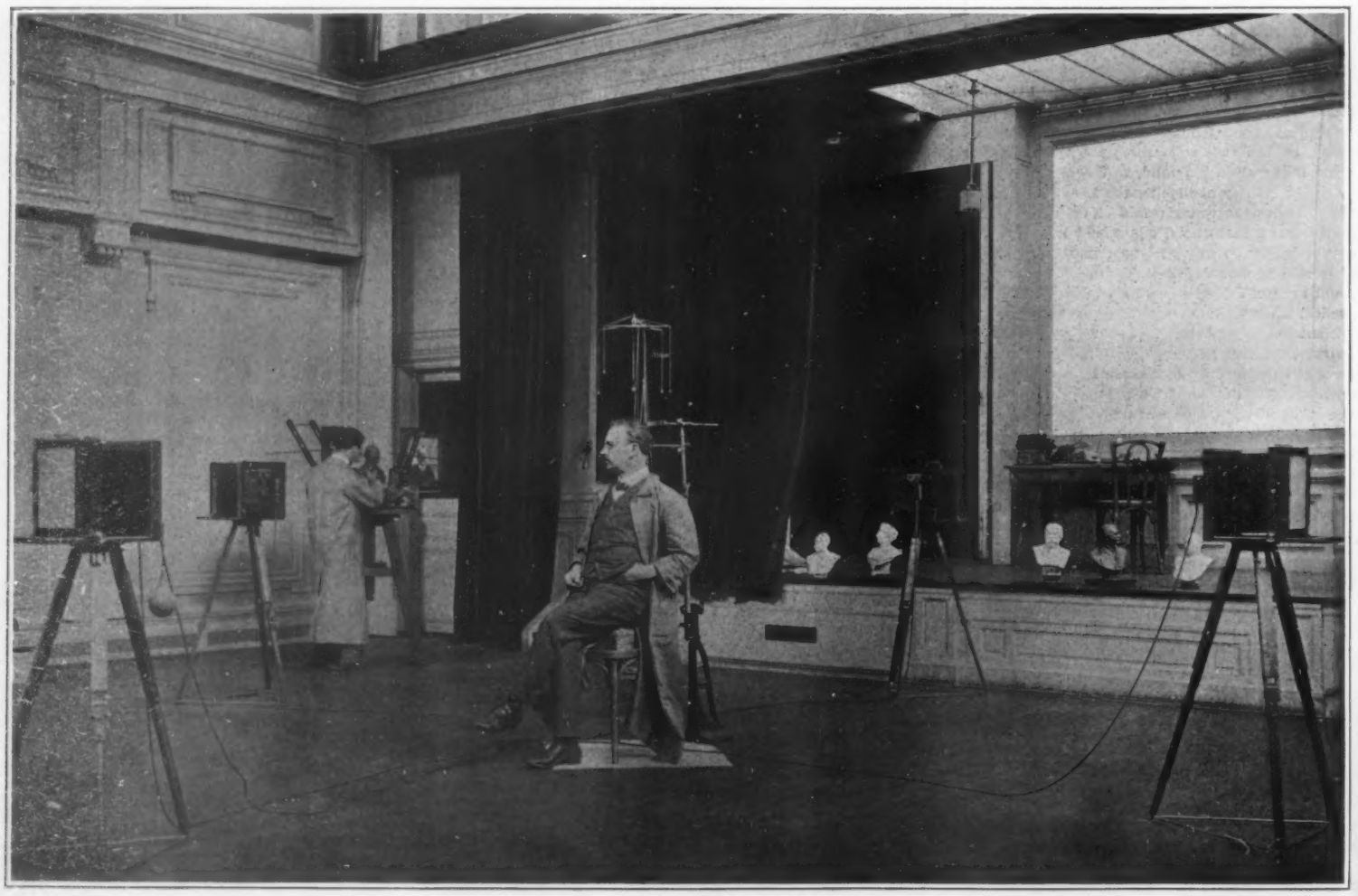


Fig. 2.—The four cameras placed for simultaneous photography. Artist finishing the bust.

been shown that the gelatine film impregnated with a dichromate becomes more or less insoluble in those parts which are acted on by light, owing to the reduction of some of the chromic acid to chromic oxide, which then combines and forms an insoluble compound with the gelatine. The swelling property of chromium gelatine, of which M. Baise availed himself, was in all likelihood taken advantage of likewise to obtain the very handsome model of the Rock Island Arsenal exhibited at the centennial exhibition in Philadelphia. The second discovery was made known about three years ago. The model was photographed on screens which were placed in different, so called, camera projectors, generally six or eight in number, surrounding the model, and, after thus obtaining a reproduction from different sides, they were projected upon a block which the sculptor cut away until the proportions coincided with those projected by two of the cameras. The question of enlarging or reducing the size of the reproduction was solved by originally placing the cameras at greater or less distances from the model.

M. Cardin, however, has materially improved upon the above-named processes. His method is not only much more simple and therefore cheaper, but one that apparently meets at this day all the requirements in which the former inventions were wanting. He reduces the needed apparatus to four cameras only, which, as the illustration shows (Fig. 2) are placed at the four corners of a room on the same horizontal plane and facing one another. Each camera is provided with a movable shutter or curtain, which can be worked by means of wires or rubber tubing connected at the other end with the release bulb held by the operator. Thus a simultaneous and identical sitting is assured for all the cameras. As seen in the illustration, the individual is placed upon a stand exactly in the center of the room, and when photographed, necessarily produces four views at right angles to one another, taken in front, in the rear, and on both sides, and, as each view represents one-half of the sitter or model, the four photographs give a double reproduction of each half. These photographs can, of course, be enlarged or reduced by the ordinary means.

The reproduction of all four views is very readily obtained. The clay is placed by M. Cardin upon a square modeler's bench or stand, made preferably of metal, along the sides of which are railings along which can easily be made to slide such upright frames as shown in Fig. 3. The same can be seen before the operator in Fig. 2. In these upright frames are successively placed the four photographs and alongside of them is affixed an articulated framework which can be brought to, and maintained in, any desired position. When, as is shown, two of these photographs are therein inserted at right angles, a long movable rod carried by each framework is brought against the photograph—say the nose, for instance. As soon as one of the movable rods touches the selected portion of the photograph, it is rigidly secured. The same is done with the other rod, after which the photographs are removed from the upright frames and both rods are brought toward each other until they exactly meet. Thus, in this case, is ascertained the exact location of that particular feature, the nose, and the clay is gradually removed by the operator until that location or point corresponds. Each portion of the pair of photographs is gone over similarly, in turn, and there is finally obtained a satisfactory clay or other reproduction of the individual or model, which needs but the finishing touches of the artist.

By his process, M. Cardin has already produced a number of busts of people who have had but one sitting, and he has lately even succeeded in obtaining similar results by means of only one camera instead of the four. In this case, he places the sitter or model in front of three mirrors, as shown in Fig. 1. But, while this reduces the amount of room required, it has the disadvantage of giving reflected images of different proportions which must afterward be rehandled in order to obtain uniformity. In Fig. 3 the last picture shows a bust lately produced by M. Cardin.

The Société d'Encouragement has awarded to M. Cardin a silver medal for his original process and it is said that he can apply the latter equally well to taking reproductions of certain specified parts of the human body, which cannot otherwise be so advantageously procured, especially in the case of serious accidents to children.

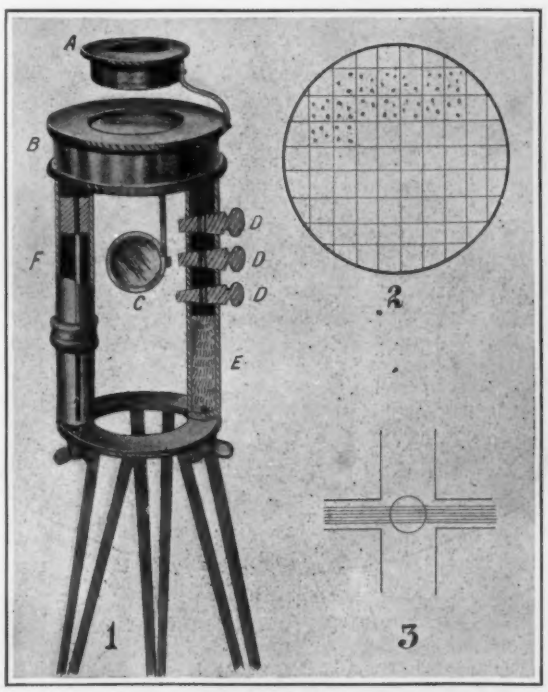
Photo-sculpture does away with the tedious processes which the individual sitter has had to submit to in the past, for it is but necessary that he now should give only time enough for the taking of a photograph, and there is strictly no need of his seeing the artist at all. The former taking of plaster and other casts as well as the necessary and frequently very numerous sittings demanded, not to speak of other requirements, are dispensed with, and this saving of time and trouble places the cost of what was heretofore a luxury within the reach of the many. As was justly remarked, a lion or other wild animal would, to say the least, make an awkward sitter before a sculptor, but the camera can hold him and thus enable the reproduction in permanent form. Incidentally, it may be added that the

Fig. 3.—Apparatus arranged for reproduction.

SCIENTIFIC AMERICAN not long since illustrated a process for obtaining heads cast from life, by means of glue molds, as taken from the *American Museum Journal*. It is said that, as far back as 1906, the American Museum possessed more than five hundred masks from life, including full series of the Siberian, the Eskimo and the North American Indian casts, and, as many duplicate casts can be made from one glue mold, the replicas are readily supplied to whatever universities, colleges, museums or others that may require them.

Counting Grains of Dust in the Air

DURING the three days, March 8th, 9th, and 10th, 1901, heavy duststorms prevailed in the desert region of southern Algeria. A widespread cyclonic storm, central over Tunis during this period, sucked up a vast quantity of dust, which during the four days March 9th-12th was carried northward by a strong atmospheric current at high altitudes. Showers of dry dust fell, at the beginning of this period, in Algeria and Tunis. On the 10th there was a general fall of dust, in some places mingled with rain, in Italy and Sicily. On the night of the 10th dust-mingled rain and snow fell over the eastern Alps. In northern Germany similar showers occurred on the 11th. On the 12th the last traces of this remarkable deposit occurred at scattered points in Denmark, Russia and England. Thanks to the enterprise of two German meteorologists, Hellmann and Meinardus, all available observations of this phenomenon were carefully collated and discussed. The movement of the dust was explained with reference to the meteorological conditions prevailing at the time; it was shown to have been transported by the upper air-currents. Samples of the dust were collected at many points and analyzed. It was conclusively proved to be of terrestrial rather than of volcanic or cosmical origin, and to have come entirely from the African deserts. The extreme distance to which it was carried exceeded 2,500 miles. The total amount that fell on the continent of Europe was estimated at about 1,800,000 tons, two-thirds of which fell south of the Alps. As much more was believed to have fallen over the Mediterranean; while on the African coast itself the deposit was supposed to have amounted to 150,000,000 tons. It was plausibly suggested that the transportation of this enormous mass of material might have appreciably affected the position of the earth's axis.



Aitken's instrument for counting grains of dust in a given volume of air.

The dustfall of 1901 was by no means unprecedented; it is chiefly noteworthy for the fact that it was more thoroughly investigated than any previous occurrence of similar character.

Off the west coast of Africa, between the Canaries and the Cape Verde Islands, haze due to dust from the Sahara is very commonly encountered by vessels, especially during the first four months of the year. This haze is said to have given rise to the ancient legend of a Sea of Darkness—a *mare tenebrosum*—lying somewhere in the ocean to the westward of the Old World. Darwin records that during three weeks that the "Beagle" lay at St. Jago a fine reddish-brown dust fell continuously. Allingham, in his "Marine Meteorology," states that 1898 was a record year for this dust-haze. On February 14th the "Roslin Castle," Capt. Travers, ran into a dense haze of this character; for over 900 miles the heavenly bodies were hidden, and the vessel was coated with a red dust. A Currie liner, the "Tintagel Castle," outward bound for the Cape, was detained by the same haze for thirty hours.

Similar deposits of dust have been observed from the earliest times. Ehrenberg, in 1849, collected records of 349 such cases, and published a map showing their distribution, which embraces the greater part of the world. The dust in the upper air is often brought down by rain. When this dust consists of fine powdery sand the rain acquires a brownish or reddish tinge, staining objects on which it falls, and constituting the so-called "showers of blood" that have been recorded as prodigies from remote antiquity. Homer describes such a shower, and many similar occurrences were recorded by the Roman historians. Italy, owing to its proximity to the African coast and the frequency of sirocco winds from that quarter, is often visited by these showers, and the superstitious peasants still look upon them as "showers of blood."

Besides the dust blown up from the earth's surface, which constitutes by far the largest part of the solid contents of the air, there are several other kinds of atmospheric dust. Meteors are an important source of dust. Meteoric dust consists largely of iron, either pure or combined with other elements, such as nickel and phosphorus. In 1871 Nordenskjöld found small quantities of metallic iron on the surface of a remarkably heavy fall of snow at Stockholm. Thinking that this might have come from neighboring roofs, he had his brother examine the snow in a forest-inclosed region of Finland, remote from human habitation, and here a similar deposit was found. Fine ferruginous particles are often found on the snowy summits of high mountains and on the ice-fields of the polar regions. Both their appearance and their composition indicate that they are of extra-terrestrial origin.

Various human agencies contribute to the dust content of the atmosphere. An enormous amount of solid matter is sent into the air as the result of the imperfect combustion of fuel. It is estimated that in London the dwelling-houses alone furnish daily 300 tons of soot to the air. Forest fires, burning peat-beds, and other conflagrations on a large scale add their quota to the dust of the atmosphere. Cinders from the great Chicago fire spread over a large part of the world. They are said to have reached the Azores some forty days after the beginning of the catastrophe. Smoke in the air is the usual cause of "dark days," of which several are historic. The most famous of these that has occurred in America was May 19th, 1780, when, in consequence of great forest fires along Lake Champlain and down to the vicinity of Ticonderoga, darkness

(Concluded on page 504.)

The Heavens in June

Silhouette of the Lunar Mountains During the Solar Eclipse

By Henry Norris Russell, Ph.D.

HOW an experienced astronomer, observing an eclipse of the Sun, can report that it was neither total nor annular, though seen from a point on the central line, may appear very puzzling. This, however, is an accurate statement of the results obtained by many observers in northern France with regard to the eclipse of April 17th of the present year. At this time the distances of the Sun and Moon happened to be in just such a ratio that the two bodies, as viewed from certain parts of the Earth's surface, appeared of exactly the same size. But, while the apparent boundary or "limb" of the Sun is smooth and circular, that of the Moon is mountainous and irregular. In consequence, when, to the French observers, the centers of the two disks appeared, for an instant, to coincide, the Sun's edge was visible, through the valleys on the Moon's limb, at many points all around the circumference, while the projecting mountains between these cut up the thin line of light which might otherwise have been seen into numerous separate portions. For a few seconds, therefore, the eclipse could not have been called total (since small portions of the Sun were still visible), nor yet annular (for no unbroken ring of solar surface could be seen).

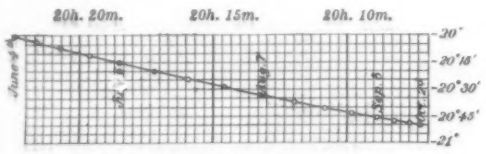
This curious phenomenon has, of course, been observable in many previous instances; but, as in the nature of the case, it can be seen only at points along an extremely narrow track, it is doubtful if it has ever before actually been intelligently observed.

The lunar mountains are, on the average, only a mile or two above the depressions between them. Observers only a couple of miles from the central line of this eclipse therefore saw a partial phase even at maximum, the thin unobscured solar crescent being unbroken by the lunar mountains on one side, and quite cut off on the other.

At one place the students of a military college, stationed at intervals of a hundred yards or so along a line at right angles to the path of the shadow, secured observations showing all the gradations between the phases described above. Such data are of considerable scientific importance, for they determine very precisely indeed just where the line through the centers of the Sun and Moon struck the Earth at the instant under consideration, and hence can be used to find whether any error exists in the tables now employed to predict the Moon's position.

Such errors actually do exist, and all observations agree in indicating that the Moon is now ahead of the place in her orbit where she ought to be according to the old tables by an amount varying from about five miles to ten miles, and fluctuating during each month. This is probably mainly due to the neglect in the older lunar tables of numerous small terms which, when combined, may add up to an easily perceptible total. When the new tables of the Moon, now under construction by Prof. Brown of Yale University, are completed, the larger part of these discordances will probably disappear. Even if something should remain, astronomers will by no means be downcast, for Prof. Brown has shown that many possible explanations might be given for such discrepancies between theory and observation. For example, some sort of interaction between the Earth's magnetic field and possible similar magnetism in the Moon.

A thorough study of the exact nature of the discordances might make it possible to run them down to their origin, and leave us, not the poorer, but much the richer, in astronomical knowledge.



The path of Uranus.

The Heavens.

As our map shows, the summer constellations are now seen in their full glory. Almost overhead we may find Hercules. Our initial letter shows the relation between the outline of the hero and the stars which represent his form; but to compare it with our map we must turn it upside down, for his head (marked by the red star Alpha Herculis) is at the southern limit of the constellation, while his feet, trampling upon the Dragon, are nearest the pole.

The stars α, δ, and μ Herculis (all shown on the map) are interesting doubles for a three-inch telescope. The first, which is brilliantly red, has a green companion, about one-sixth as bright as itself, at a distance of 5 seconds. Delta Herculis has a neighbor of the eighth magnitude, at 15 seconds distance, which has, however, no real connection with the brighter star, for the two are moving in very different directions, and in a few centuries will be widely separated.

Mu Herculis has a companion of the ninth magnitude, 30 seconds distant, which is traveling with the principal star, at the relatively rapid rate of 80 seconds per century. The parallax of this star has been determined by several observers with fairly accordant results, so that we can say with some confidence that its distance from us is about thirty light-years. The faint companion is itself a close double, separable only with good-sized telescopes, whose components complete a revolution in their orbits in about forty-five years.

About one-third of the way from γ toward ζ Herculis (which last, by the way, is another neighbor of our system, at a distance of about twenty-two light-years) one may see, even with a field glass, a faint hazy spot of light. With a large telescope, this shows itself to be one of the most magnificent star clusters in the heavens—a globular mass of thousands of tiny stars. Small instruments will scarcely be able to "resolve" it into separate stars, but will show it quite well enough to repay looking at it.

South of the zenith we find the semicircle of the Northern Crown, and below this the tangled mass of Ophiuchus and Serpens. Lower still is Scorpio—one of the most splendid groups in the sky. Sagittarius is rising in the southeast, and a few stars of Centaurus are setting in the southwest. Boötes is high in the west, with Virgo and Leo lower down. Gemini has set at the hour for which our map is made, but just after dark the constellation is still visible, and Enebo's new star (now sunk below the seventh magnitude) may yet be seen with a field glass.

Ursa Major is conspicuous in the northwest, and Draco and Ursa Minor in the north. Cepheus and Cassiopeia are in the northeast—the last low down. Cygnus, Lyra and Aquila fill the eastern sky.

At 11 o'clock: June 7.
At 10½ o'clock: June 14.
At 10 o'clock: June 22.

At 9 o'clock: July 7.
At 8½ o'clock: July 14.
At 8 o'clock: July 22.

At 9½ o'clock: June 30.

NIGHT SKY: JUNE AND JULY

The Planets.

Mercury is in conjunction with the Sun on the 17th, and is practically invisible all through June. Venus is likewise near the Sun, rising half an hour before him on the 1st.

Mars is evening star in Cancer, setting about 10:20 P. M. in the middle of the month. He is now about 200,000,000 miles distant, and appears like a star of the second magnitude.

Jupiter is in Scorpio, a little above Antares. He is in opposition on the morning of the 1st, and that evening crosses the meridian at 11:55 P. M. After this he "souths" about four minutes earlier each night, and is on the meridian at 9:37 P. M. on the 30th.

Saturn is morning star in Taurus, rising about 3 A. M. in the middle of the month. Uranus is in Capricornus, and crosses the meridian about 2:30 A. M. on the 18th. His right ascension and declination may be read from the diagram with sufficient accuracy to make it easy to find him with a suitable instrument. Neptune is in Gemini.

The Moon is in her last quarter at 9 P. M. on June 7th, new at midnight on the 14th, in her first quarter at 3 P. M. on the 21st, and full at 8 A. M. on the 29th. In her apparent motion she passes near Uranus on the 4th, Saturn on the 13th, Mercury and Venus on the 14th, Neptune on the 16th, Mars on the 18th, Jupiter on the 26th, and Uranus again on the morning of July 1st. These conjunctions are all remote, and of less interest than the occultation of the bright star Antares, which takes place on the 26th. As seen from Washington, the star disappears behind the Moon's dark limb at 11:08 P. M., and reappears at 12:22 A. M.

At 2 P. M. on June 21st the Sun reaches its greatest northern declination, and passes the solstitial point, when, according to the almanac, summer begins.

Princeton University Observatory.

Sir William White, K.C.B.

The Father of the Modern Battleship

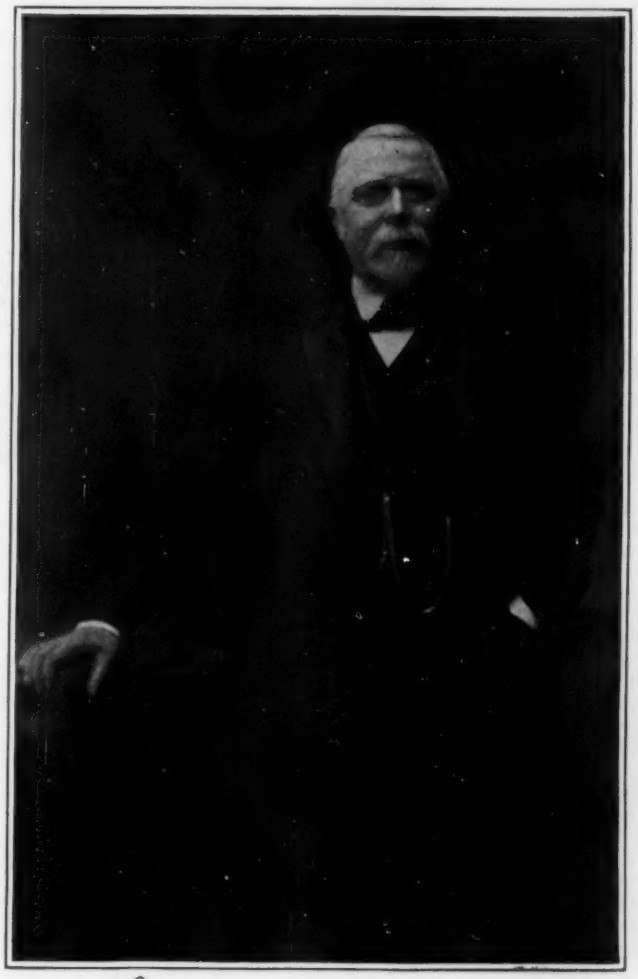
SIR WILLIAM WHITE, K. C. B., was born at Devonport, on February 2nd, 1845. In 1859 he was apprenticed to the head of the shipbuilding department—the master shipwright—in the Royal Dockyard at that place. Four years were spent by him in practical work on ship building and repairing in the dockyard, and in attendance at the dockyard school. This period was followed by two years' superior instruction in the drawing offices and at school as an Admiralty scholar. Eight years of continuous training, embracing both the practice and science of shipbuilding, were completed in 1867, and its extended and exhaustive character furnished adequate preparation for the professional career which followed, with a great variety and responsibility of employment.

That career naturally falls into four principal sections. The first (1867 to 1883) was devoted to service in the constructive department of the Admiralty. Three years were spent as confidential assistant to Sir Edward Reed, Chief Constructor of the Royal Navy. On the retirement of that gentleman (in 1870) a council of construction was appointed with Sir Nathaniel Barnaby (Director of Naval Construction) as its president, and White became its secretary and by successive steps he rose in the department until he became a chief constructor. Long periods were occupied also in detached service at the dockyards on occasions when unusual difficulties had to be faced in the construction of special types of warships. New methods of calculation had to be devised in connection with investigations of the stability and strength of ships; in these departments White (with his fellow student, the late William John) took the leading part. Concurrently with this professional work at the Admiralty he also filled the position of Professor of Naval Architecture—from 1870 to 1881—first at his old school, and afterward at the Royal Naval College, Greenwich. During this period a large number of foreign students were attracted to the school. Among these were Admiral Bowles (afterward Chief Constructor, U. S. N.) and other Americans; Captain Tuxen (now Director of Naval Construction of the Danish Navy), and many others who have since attained eminence as designers and builders of ships. Partly as a result of this educational work came the production of the well-known "Manual of Naval Architecture" and other works of a professional nature which have attained wide circulation throughout the world, have been translated into various languages and made text books for use by officers of the British, American, German, Italian and Russian navies. On the practical side of his work as a naval architect White was concerned with many important experimental investigations.

In 1882 the firm of Armstrong, Mitchell & Co. offered to Sir William White the position of director of the new warship building department which was to be established near their ordnance department at Newcastle-on-Tyne. The offer was accepted. This second section of White's professional career as head of a great private establishment extended over the next three years. The work done included the construction of a new shipyard on the foreshore of the river containing numerous large slips. The organization of the department and its staff was also carried through. Sir William White assumed responsibility for the construction of the yard, and before long he began the construction of warships from his own designs for the Japanese, Italian and Austrian navies. These were followed by Spanish and Chinese cruisers, and by large contracts with the British Admiralty. The total value of the contracts secured within three years was about eight million dollars, and the establishment had been brought into full working order, large numbers of men being employed. Before his connection with the Armstrong firm ended the Secretary of the United States Navy (Mr. Whitney) purchased two cruiser designs prepared by Sir William White, and from these designs the "Charleston" and "Baltimore" were built in America. Two Spanish cruisers which fought at Manila and were captured by Admiral Dewey were also designed by him and built on the Tyne.

In October, 1885, Sir William White returned to the Admiralty on the invitation of the Board of Admiralty, was appointed Director of Naval Construction in succession to Sir Nathaniel Barnaby and began the third period of his professional career. The additional appointment of Assistant Controller of the Royal Navy was given to him soon after—an appointment which had been held by no preceding head of the ship designing department of the Admiralty, and which has not been continued to his successor.

In this responsible office he continued until the end of January, 1902. Ill health—the result of long-continued overwork—then compelled him to retire at the age of fifty-seven, and Parliament made a special grant to him in recognition of long and valuable services to the navy. These sixteen and a half years were remarkable; there were crowded into them enormous shipbuilding programmes, while great advances were made in warship design and armament. The work done was summarized by Sir William White in his presidential address to the Institution of Civil Engineers in November, 1903. About 250 warships, including 69 armored battleships and cruisers, had been built or were building from his designs.



Yours sincerely
W. H. White

After two years' rest, however, Sir William White was sufficiently recovered to make a new departure. He became consulting naval architect for the great Cunard steamship "Mauretania" and a director of the private firm which undertook her construction. He was most actively and intimately concerned with the design of that vessel from its inception through all its stages up to the triumphant success attained on the final trial. This fourth period in the career of Sir William White as a consulting naval architect in private practice has now extended over eight years. He has kept aloof from warship design, but has played the part of critic on many occasions, dealing, however, with general naval policy rather than with technical questions of warship design.

Since his retirement from the public service Sir William White has taken a leading part in the proceedings of the principal British engineering societies, and has been particularly interested in the promotion and organization of technical education. He has served as president of the Institution of Civil Engineers, the Mechanical Engineers, the Marine Engineers, the Institute of Metals, and the Junior Institution of Engineers, and as chairman of the Council of the Royal Society of Arts. He has presided over the Smeatonian Society of Engineers (founded in 1771), and was in 1896-7 master of the ancient Shipwrights Company in the city of London. He is also a member of the Court of Goldsmiths Company, which is a still more ancient association, distinguished by generous support of scientific education and research. He is honorary vice-president of the Institution of Naval Architects, that society being the only technical body in Great Britain which prefers to have a non-technical president.

Many engineering societies in Great Britain and abroad have enrolled him as honorary member. Among these may be mentioned the American societies of Civil Engineers, Mechanical Engineers and Naval Architects, the Canadian Society of Civil Engineers and the Association Technique Maritime of France. The John Fritz Medal for 1911 has been awarded to Sir William White "for achievements in naval architecture" by the special board appointed by the four great American engineering societies. At home, too, he is honorary member of many engineering societies, including the Society of Engineers, the Engineers and Shipbuilders in Scotland, the North East Coast Institution of Engineers and Shipbuilders, the Liverpool Engineering Society and the Aberdeen Association of Civil Engineers.

Sir William White was elected a Fellow of the Royal Society of London in 1888—the highest scientific distinction possible to a British citizen. He is also a Fellow of the Royal Society of Edinburgh and a member of the Royal Academy of Sciences in Sweden. Honorary degrees have been conferred upon him by many universities, including the Doctorate of Science of Cambridge and Durham in England, and of Columbia University in the city of New York; the Doctorate of Laws in Glasgow; the Doctorate of Engineering in Sheffield University. As the result of his persistent advocacy, professorships of naval architecture have been founded in the universities of Liverpool and Durham—the latter at Newcastle-on-Tyne—during recent years. In later years Sir William White has devoted much time and energy to the promotion of higher technical education.

Lead-coated Steel

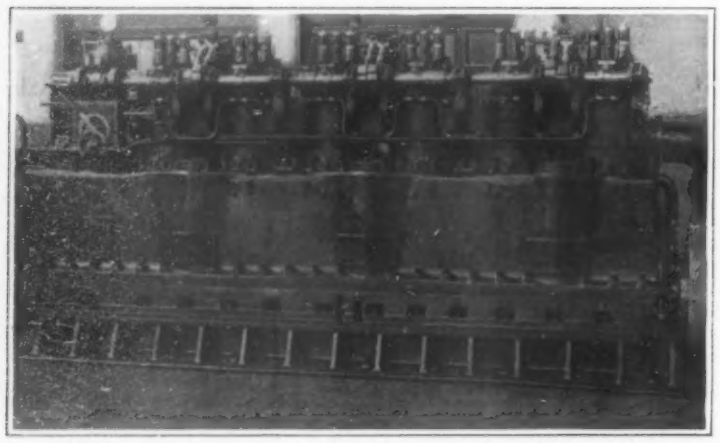
THERE has recently appeared on the market a form of roofing consisting of sheet steel, coated with pure lead. This material is superior to the galvanized material, or sheet steel coated with zinc, as it is not subject to cracking and flaking, and will not resist painting as does the zinc surface. The electropotential relationship between lead and iron is very much closer than that between zinc and iron, and so the lead coated steel is not readily susceptible to chemical influences. The new material also has advantages over terneplate. The latter has a coating which is 70 per cent lead and 30 per cent tin, but as long as there is any tin in the coating the sheets are liable to rust. Terneplates are also easily attacked by gases, whereas the lead coat of the new material is very inert to all action of gases. The new material weighs 3/100 of a pound per square foot more than galvanized iron. It can readily be painted without the use of acids, and it may easily be soldered. When it comes in contact with rain or pure water, there is slight dissolution of the coating which shows in discolored spots. These may be rubbed off and the coating will be found intact. One coat of good paint will prevent this discoloration.

Protecting the Name "Sheffield"

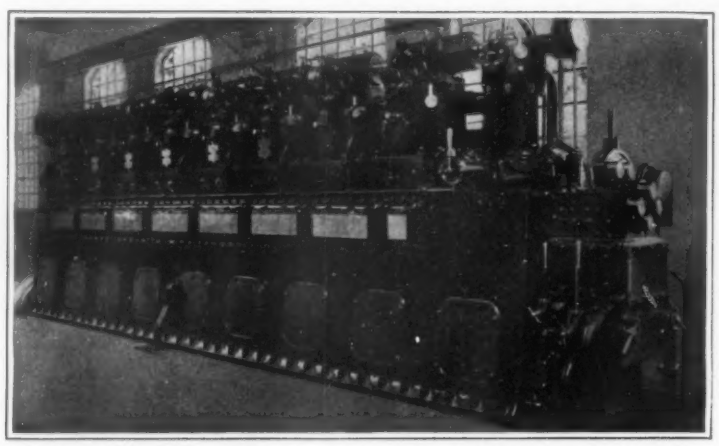
THE trade of Sheffield has suffered from the fact that the name of that city has been widely used on cutlery and other wares made elsewhere. A committee of prominent citizens has now been formed and a fund has been raised to undertake the prosecution of all these cases, so far as they can be reached by the law.

What Inventors Are Doing

Simple Patent Law; Patent Office News; Inventions New and Interesting



1000 brake horse-power F.I.A.T. Diesel engine for submarines and torpedo boats.



850 brake horse-power two-cycle single-acting, reversible Nürnberg-Diesel engine for submarine boats.

The Two-cycle Marine Diesel Engine

By the English Correspondent of the Scientific American

UNDOUBTEDLY the greatest activity in developing the Diesel engine for marine use is now being displayed by the Maschinenfabrik Augsburg of Nürnberg. This company has evolved several ingenious types including double-acting two-cycle, four-cycle, and reversible, single-acting, two-cycle engines, replete with many ingenious details.

The reversible, single-acting, two-cycle engine is built in two types, light and heavy, respectively. The first named, having a weight of about 33 pounds per horse-power, is suited for naval purposes such as mosquito craft and submarines. They are of the multi-cylinder type, having six or eight cylinders to the propeller shafts. This multi-cylinder arrangement insures a very uniform turning movement. Where the output does not attain a certain figure and where the floor space is limited, four-cylinder engines are used. These average about 40 pounds per horse-power. These weights, however, are inclusive of all auxiliary machinery as well as the reversing apparatus, oil and water. When the four-cylinder system is adopted, a fly-wheel is requisite. The six-cylinder engine is very popular, ranging in output from 150 horse-power at 500 revolutions per minute to 2,000 horse-power at 300 revolutions per minute.

The heavy engines of the same type range about 110 pounds per horse-power inclusive of all auxiliaries. The greatest advantages of this type over the light-weight engines are lower fuel consumption, lower first cost, and less crankshaft speed. They are eminently adapted for continuous working and in the six-cylinder type the revolutions range from 300 to 400 per minute, for engines of 150 to 200 horse-power, to 185 per minute for 2,000 horse-power.

In these engines direct reversibility is secured and they can be coupled to the propeller shafts without the intermediary of gearing or reversing clutch. Reversing is secured by the aid of compressed air, which reverses the valve gear and restarts the engine. A vessel proceeding at "full speed ahead" can be reversed to "full speed astern" in a few seconds. The control of the engine is such that the revolutions of the engines can be reduced to one-third. This enables the speed of the vessel to be varied within a wide range, so that its maneuvering capabilities are enhanced.

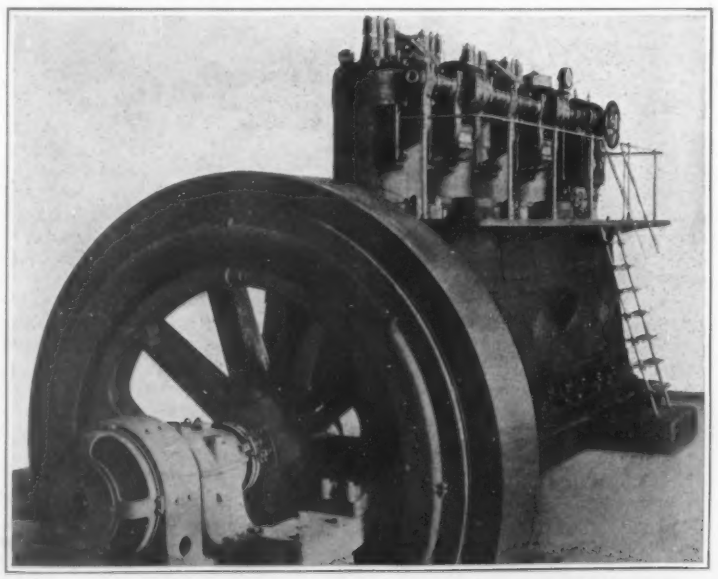
The engines work on the two-cycle principle and are single acting, the combustion of the fuel being under constant pressure in accordance with the so-called Diesel principle. The cycle is as follows: On the up-stroke of the piston, pure air is compressed in the working cylinder to about 500 pounds per square inch, and thereby becomes very highly heated, the temperature then being far above the flash point of the fuel oil. Just before the up-stroke is completed the fuel needle, which acts as a valve as well as an atomizer, opens. The atomized oil is forced into the cylinder under the action of compressed air for a short time at the beginning of the downward stroke. As the piston commences to descend, combustion of the charge under constant pressure takes place, the products of combustion working by expansion and so forcing the piston down. This, therefore, is really the working stroke. At the end of the stroke the burnt gases are exhausted through slots in the cylinder the moment these are uncovered by the piston. At the same time slightly compressed air at a pressure of between 5 and 7 pounds per square inch enters through a special inlet port on top of the cylinder, drives out all the burnt gases of the previous charge, and fills the cylinder with pure air, which is compressed as the piston re-ascends, when the cycle of operations is repeated.

A special compressor is used to compress the injection air to about 860 pounds per square inch. One of the greatest advantages of the Nürnberg two-stroke oil engine is that the cylinders are scavenged and charged only with pure air, and not, as in the case of the majority of two-stroke engines, with a combustible mixture. Consequently, scavenging can be carried out with a great excess of air. The cylinder thus becomes thoroughly cleansed after each charge is fired and the products of combustion are swept away and high medium pressures are admissible. Yet the mean temperature of the cylinder is not so high as to endanger the reliability of the engine. In consequence of these high medium pressures the weight of the engine is light.

The scavenging charges of air are supplied by special pumps fitted beneath the working cylinders. The scavenging pump and working cylinder have the same piston. The piston is stepped, the lower and large step serving for the scavenging pump and, at the same time, as a crosshead, and the upper step serving as the working piston proper. The air for injecting the fuel is supplied from a two-stage compressor. The working cylinder and the compressor are water-cooled over their entire surfaces. If salt water is used for cooling, care is taken when laying the piping that only metals of the same kind are laid in contact with each other, so as to prevent as far as possible any electrolytic action. The pistons are cooled with lubricating oil, and in the event of leakages arising the bearings of the engine cannot be endangered.

In the smaller sizes of engines the fuel consumption averages about 0.5 pound per brake horse-power hour and for the larger engines about 0.44 pound per brake horse-power hour, these figures applying to the fuels mentioned later.

The engine is directly reversible. It is started and reversed by compressed air, supplied from the compressor provided for furnishing the injection air. A single lever controls both operations. In order to facilitate and expedite maneuvering there is no flywheel, and the engine can be reversed from "full speed ahead" to "full speed astern" within a few seconds.



Slow-running Diesel engine for freight vessels; it develops 1000 horse-power at 150 revolutions per minute.

So far as the fuels are concerned, all the cheap by-, and intermediate, products of oil refineries and gas works, in addition to kerosene, constitute the most suitable fuel for the Nürnberg two-stroke engines. These residues as a general rule have a specific gravity of 0.85 to 0.95 and a flash point varying between 120 and 360 deg. Fahr. Their net heat value is about 18,000 British thermal units per pound. Crude mineral oils may be used also, but they are liable to contain mineral elements and asphalt.

In Italy the manufacture of these Diesel engines is being undertaken upon a large scale by the Fabrica Italiana Automobili Torino, the manufacturers of the famous F.I.A.T. automobiles. For some years past this company has made a specialty of large high-powered gasoline motors, suited for the propulsion of submarine boats, but as the advantages of the heavy oil engine came to be realized, it was taken up extensively as being more suited to submarine work, owing to its greater safety. They have adopted the two-cycle reversible type and manufacture the engines in two distinct classes—high-speed light engines for naval work, and slower running heavier engines for freight boats and general marine purposes.

The engines of the first class range from 100 horse-power at 600 revolutions per minute to 1,000 horse-power at 400 revolutions per minute. In the heavier class the 100 horse-power is developed at 300 revolutions per minute and 1,000 horse-power at 150 revolutions per minute.

In this engine there are no independent pumps for discharging scavenging air into the cylinders after the combustion of the fuel charge, but the pistons have a double diameter. The upper part of the cylinder which is of smaller diameter is the working piston, while the lower part, of larger diameter, acts as an air pump. By this means it is possible to reduce the length of the motor very appreciably and the balancing is rendered easier. The lower part of the motor consists of the base plate which carries the main bearings for the crankshaft, and the working cylinders are separately secured to a frame on this plate. The upper side of the frame is used as a reservoir for the scavenging air, this being compressed to from 3 to 6 pounds per square inch, according to the speed of the engine.

The reversing of this engine is effected upon very simple lines, and in the official tests carried out by the Italian navy it was found possible to change from "full

speed ahead" to "full speed astern" in five seconds.

The success of the F.I.A.T. company in connection with these Diesel engines has led to an important step. The Italian Government has placed an order for the construction of oil engines developing an aggregate of 12,000 horse-power to be fitted to one of the new warships under construction for the navy. The engines have not been placed in hand yet, as, according to the advice extended to the writer by the builders, the requisite data and experiments for such a large unit have not yet been completed, but it is anticipated that the engines will be undertaken shortly. This is the largest unit that has yet been attempted with Diesel engines, the highest horse-power otherwise attempted being 5,000, which are being built at Nürnberg for the German navy. The successful construction of such large high-powered engines suited to naval purposes is one of paramount importance to the Italian Government, owing to the absence of native coal resources, while oil, on the other hand, is easily and quickly obtainable, as well as being considerably cheaper.

Is it Right to Maintain Prices on Patented Articles?

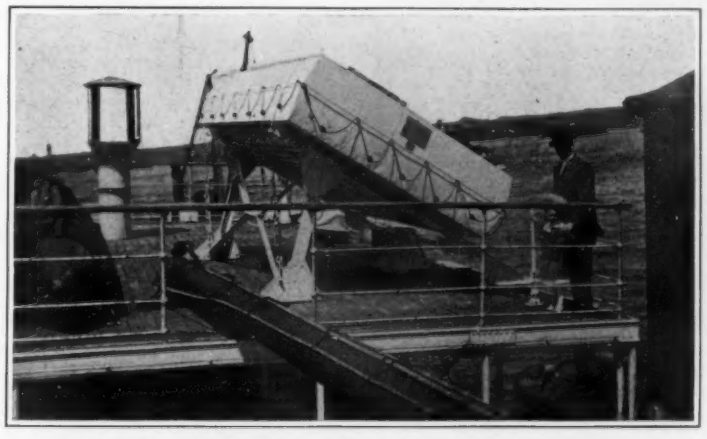
By J. George Frederick, Vice-President of the Business Bourse

ONE good, perhaps, has undoubtedly been accomplished by the introduction in Congress of House Bill No. 23,417 (aiming, among other things, to eliminate the privilege of sellers of patented goods to maintain the prices all the way down the line to the consumer). This good is the free and frank discussion of the economics of selling under modern complicated conditions.

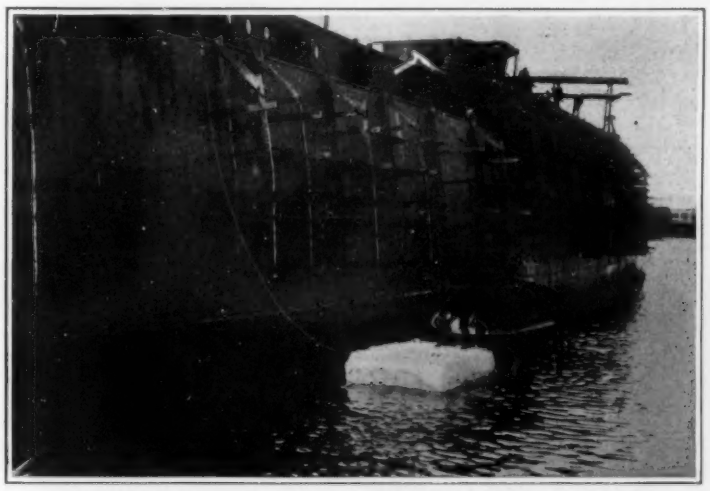
Scores of manufacturers, facing the revocation of the privilege of patentees to restrict their prices, have been obliged to think more deeply and from a wider perspective of mind than ever has been demanded of them. In their own practical way they have worked out practical plans of selling and distribution in a vast country full of conflicting factors; and now, that they are brought before the bar of trial at a Congressional hearing, they have been obliged to justify the universal movement among all manufacturers to fix the retail price at which their goods are to be sold, and convince politicians of the general benefit and sound economics of their plan.

Not only the sellers of patented merchandise, but the sellers of all merchandise have always felt the destructive hand of the price-cutter, and have instinctively endeavored to maintain prices by some means or other. Dealers have made this more than ever possible by, in a large majority, favoring the fixing of retail prices, because of bitter experience in trying to make a profit out of an article which was being indiscriminately cut in price by mail order houses, department stores and individual pirates of reputation. Ninety-eight per cent of the dealers handling Eastman kodak goods voted to continue fixed prices on Eastman goods, when canvassed; and 91 per cent of dealers handling Waterman fountain pens said the same thing. Both are patented articles. But the seller of patented merchandise has always had a very definite advantage over the seller of staple goods because of his "exclusive right." The owner of a patent is able instantly to sue the offending price-cutter on the grounds of contributory infringement. Had the seller of the patented article not had this right he would have suffered much more than the seller of the staple goods, for the simple reason that a market does not exist in the beginning for a patented article—it must be developed from the ground up; whereas, a staple article always has a staple market which can be relied upon. Consequently, in order to persuade dealers to keep in stock a patented article, and thus give the public an opportunity to buy the new improvement at stores from one end of the country to the other, it has become a definite settled necessity to maintain retail prices. Otherwise no distributive organization of any size whatever, nor any business of certainty of growth could ever be established for a patented article without the most monumental difficulty. The earnestness with which sellers of patented goods are, therefore, asking Congress not to pass this proposed clause is most understandable.

The great trouble has been that, offhand, the public is with any attempt to "cut prices." It makes the mistake of supposing that a maintained price is necessarily a high price. As a matter of fact, owners of patents have been just as earnest in prosecuting the dealers who sold *above* the set price as those who sold below. Their entire concern was for the stability of the price, and the accomplishment of the goal of making their goods practically as interchangeable as cash. In fact, there are a number of sellers of patented articles who actually take back from the dealer, at the same price the goods were sold to him, anything which the dealer desires to return or for any reason cannot sell.



Mounted on inclined ways. Launched by the turn of a lever.



The life-raft thrown from the Argentine battleship "Rivadavia."

The thing that stands out in all the discussion which has been raised by the proposed amendment is the fact that certain necessary procedures must be gone through for any seller of merchandise to secure a broad and full national market. The first element of this procedure is the uniform maintenance of prices. If the public desires to get a good article of uniform quality and responsible guarantee, which will stay in the market, it is necessary that the public should agree to the doctrine of a standard price. Without this the article of quality will soon disappear from the market, because it cannot maintain the same quality at a price to which price-cutting finally forces it. The unfortunate part is that there are hundreds of articles now on the market, the manufacturers of which originally started with laudable intentions of high quality at a standard price, but have been forced by the cruel pressure of price-cutting to greatly lower the quality or the standard of weight, size or gage, until the public is getting far less than it ought to get—though it remains fooled, believing that it is buying the goods several cents less than its original set price.

The answer to the chief one of the arguments made against price maintenance, that it develops monopoly, is very simple: The present anti-trust laws take precedence over the patent laws, and any monopoly which has grown around the abuse of patent privileges may quickly be reached by present anti-monopoly laws. The answer also to those who oppose the extension of the privilege of sale restriction of accessories to the patent article is that it is entirely legitimate for the manufacturer of a device to specify the use of a certain accessory if that accessory is really necessary to the successful operation of that device. The reasonable line between this and the concern which obviously uses this privilege to tie up a great many accessories with its patent privileges is a matter which does not affect the principle at stake, but rather the abuses of it, and it should be possible to right the abuses of the principle without annihilating the principle itself. President Taft, in advocating to Congress the appointment of a commission to go into the subject carefully, recognizes the deep underlying economic seriousness of the matter.

An Interesting Type of Life-raft

THE disaster that befell the ship "Bourgogne" in the summer of 1898 was followed, as has been the wreck of the "Titanic," by a flood of inventions designed to prevent the recurrence of such a disaster. Among the inventors at that time was one who had been a steward on the "Bourgogne," and only a short time before the wreck was transferred to the steamship "Touraine." Mr. Matson's escape and his conversation with members of the rescued crew who were taken back to France on the "Touraine," started him in pursuit of a non-sinkable, non-capsizable life-raft. He realized that one of the principal difficulties with the ordinary life-raft attends the launching of the device; hence, he devised a special launching mechanism devoid of complicated gear, and so arranged that a slight pull on a lever would release the raft and send it bounding into the sea. The launching gear consists of ways set at an angle of about 45 degrees with the deck of the vessel, so that the raft which is mounted on wheels will readily slide overboard when the heavy iron chains that hold it are released. The raft itself consists of a rectangular ring with a flooring of slats. Should the raft land upside down on the water, the flooring may be dropped to the lower side by withdrawing a couple of pins. The raft shown in our illustration is twelve feet long, nine feet wide, and three feet deep. It will easily bear the weight of sixty-five persons, and handholds are provided on the outside of the ring for others. Two of these rafts are in use on board the "Provence." One of our illustrations shows a test recently made of throwing the raft overboard from the battleship "Rivadavia," which is now being built for the Argentine Republic.

Notes for Inventors

A Baseball Curver.—Just at the opening of the baseball season, Ralph Wilson Jones of Lincoln, Neb., secured a patent (No. 1,025,748) for a baseball curver which has a vacuum cup of a yielding resilient material designed to collapse to a greater or less extent according to the amount of curve it is desired to give the ball. A retaining band is connected to the cup and fits around the fingers to hold the cup in position.

Tire-filling Compound.—The difficulties experienced in the use of pneumatic tires excites interest in tire-filling preparations such as that disclosed in patent No. 1,025,000 to Howard I. Manley of Kansas City, Mo. He provides a filling compound that includes gelatin, glycerin and balsam of fir together with fine cork and potassium bichromate. A feature of his improvement is to exclude the mixture from the action of light and air prior to filling it into a tire.

A Steinmetz Light Patent.—Charles P. Steinmetz, assignor to the General Electric Company, has patented (No. 1,025,932) a means for producing light wherein an arc is drawn from a mercury terminal and diluted salts of alkali metals are continuously furnished to the arc. The metallic compounds so furnished are in a chemically inert condition and are ionizable at the temperature of the arc.

A Large Issue of the Gazette.—The exceptionally large patent issue of May 7th contained 766 patents to citizens of the United States. Of these New York State led with 125, Illinois being next with 101 and Pennsylvania third with 97. Nine patents were issued to residents of the District of Columbia.

Legal Notes

A Jenkins Starting Device for Gasoline Engines.—Charles Francis Jenkins, the well-known inventor of Washington, D. C., has patented (No. 1,024,077) a starting device for internal combustion engines in which there is provided in connection with a series of engine cylinders and a carbureter, a reservoir with a pump drawing gas from the carbureter and forcing it into the reservoir, a valve preventing the return of the gas to the carbureter and another valve normally preventing the return of gas from the reservoir to the pump. He utilizes means whereby excessive pressure in the reservoir holds the last mentioned valve open and a distributor casing in open communication with the reservoir has conduits which lead from the distributor to the cylinders and hand-operated valves normally close all the said conduits. In the distributor casing is a valve which is adapted to keep the reservoir at all times in communication with at least one of the conduits leading to the cylinders. The same inventor has patented a tire repair device (No. 1,024,078) in which a metallic plate of lattice-like form has hooked ends which are adapted to engage the opposite edges of tire rims to confine a section of the tire under the lattice-like plate. The hooked ends of such plate engage beneath the tire-retaining flanges of the rim, the rim thus serving to retain the plate in position.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

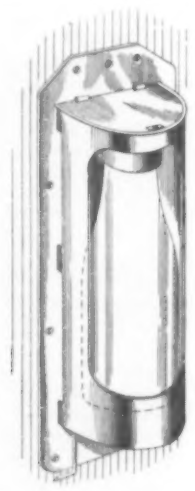
BUTTONHOLE MARKER FOR SHOES.—E. T. ADAMS, Portsmouth, Ohio. The object here is to provide a device by means of which all the buttonholes may be marked at one operation, thereby saving time consumed in the marking operation. The number of buttonholes to be marked may be varied while still maintaining the proper relative distances between the marks.

Of Interest to Farmers.

REEL ATTACHMENT FOR MOVING MACHINES AND HARVESTERS.—I. C. BENSON, P. O. Box 350, Sumas, Wash. This attachment is particularly applicable and valuable in the arid or semiarid portions of country where drouth prevails. The reel proper is provided with bars or blades adapted for adjustment radially, so that they may be set farther from or nearer to the reel shaft, according to the height of the standing grass or grain.

Of General Interest.

SAFETY HOLDER FOR BOTTLES, JARS AND OTHER RECEPTACLES.—G. F. BARR, 496 W. 165th St., Manhattan, N. Y. In the present invention is an improved safety holder for milk bottles, jars and the like receptacles, intended to be attached to a suitable support and to receive and retain a bottle against unauthorized removal. An authorized person, by use of a key, can readily open the lock and swing the cover open for removal of the receptacle from the casing, as pictured in the perspective view of the safety holder for a milk bottle locked in position in the holder.



SAFETY HOLDER FOR BOTTLES.

WAVE MOTOR.—J. W. NEAL, Kealia, Kauai, Hawaii. This invention relates to a motor for utilizing the power generated by the waves of a body of water and transforming it into available energy. It provides a flexible transmission member with a plurality of propellers or turbines connected thereto in such a manner as to absorb a portion of the energy of the waves of a body of water in which the device is placed.

HORSESHOE CALK.—W. I. MILLER and J. MILLER, 608 E. 7th St., Red Wing, Minn. This improvement refers to horseshoe calks and particularly to removable toe calks, and has for an object the arrangement of an improved structure which may be easily applied and removed, but which will normally remain rigidly in place.

EXTENSION BURIAL CASKET.—A. FRANKE, Cuero, Tex. This inventor provides a casket formed in two main sections having means for direct engagement with each other to form a casket of given length, and a third section which may be fitted between the two main sections for giving the casket an increased total length.

MEDICINE DROPPER.—DR. J. D. WISE, Main and Market Sts., Jackson, Tenn. The intention here is to provide a device by means of which the liquid contents of a receptacle may be accurately removed drop by drop and which will thoroughly mix and incorporate the contents or ingredients in the receptacle during the operation.

WATER FILTRATION AND SUPPLY SYSTEM.—A. B. SMITH, 1803 Newton St., N. W., Washington, D. C. Mr. Smith has obtained Letters Patent of the U. S. for an improved system of economic water filtration and supply for towns and cities, in which perforated intake pipes are located in the bed of a river or other stream and buried in sand forming a natural deposit and filtering medium.

BARBER'S CABINET.—G. TOUS, care of D. G. Lagos, Box 5, Montevideo, Uruguay, S. A. An object of this inventor is to provide a cabinet so arranged and constructed as to contain a volatile antiseptic substance to sterilize the razors when not in use, and to sterilize the wiping paper as it is withdrawn from the cabinet. A further object is to provide a wiping and stropping surface on the outside of the cabinet.

HAMMOCK.—J. J. MAXWELL, 500 Maryland Ave., S. W., Washington, D. C. The present invention is designed as an improvement on that disclosed in a prior patent granted to Mr. Maxwell, and the main purpose is to render the device more stable. A further object of the invention is to facilitate the assemblage of the parts, and to permit the device to be taken apart for transportation or storage.

VENTILATOR.—G. R. SIEFKEN, 127 Vermilyea Ave., New York, N. Y. The purpose here is to provide a ventilator which can be installed at windows or other openings in buildings, railroad cars and the like which cuts off a minimum of light, the operation of which will not be affected by accumulations of dust and the like, which is practically noiseless in operation, and which prevents excess of air from entering the structure to be ventilated, regardless of wind velocity or air pressure at the outside.

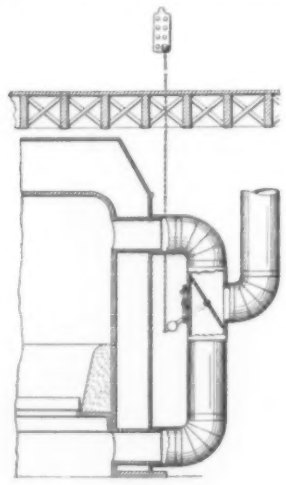
Hardware and Tools.

CARBORUNDUM DRESSER.—A. C. CHAMPAGNE and J. N. BRAHN, Jersey City, N. J., care of Dr. A. C. Champagne, 461 Fairmout Ave., Jersey City, N. J. This dressing wheel is for use in renewing the surface of wheels employed by dentists in finishing fillings and grinding away teeth. Such wheels are made of carborundum in practice, and the circumference of these wheels become smooth after extended use.

FLUE CLEANER.—H. C. MCKEEL, Newbern, N. C. This invention relates especially to the particular construction of the scrapers proper whereby to secure an efficient, economical and durable form of scraper. The construction permits the convenient adjustment of the tension of a spring to suit the cleaner to flues of different sizes.

Heating and Lighting.

DAMPER.—W. J. MORELAND, Mottville, N. Y. The aim of the inventor is to provide a form of damper for use on furnaces or other heating plants by means of which the furnace draft may be carefully governed, the damper being especially adapted for operation in parts of the house remote therefrom. The invention provides complete control of the fire from direct to reversed draft, with one chain running to rooms above; and provides relief from dust and gas when joints in a stove or furnace become imperfect from long use or any other cause. The construction is simple and does away with the ordinary check and other dampers. Heating appliances can be manufactured as cheaply with this improvement as without. The engraving shows a side view, partly in section, representing a furnace flue equipped with the invention.



DAMPER.

LANTERN SUPPORT.—J. BURKE, care of Burke Bros., Ellsworth, Minn. This support is more particularly adapted for holding a well-known form of lantern resiliently positioned on a vehicle or other movable body. The invention provides a simplified form of holder containing relatively few parts that might get out of order, and it simplifies the cumbersome constructions now used for this purpose.

Household Utilities.

COMMODE.—C. H. BARRETT, 541 W. 142nd St., Manhattan, N. Y. This invention pertains to a new and improved form of commode, and is especially adapted for use in sick rooms, hospitals, etc. An object is to provide a simple, neatly constructed article of this character, which is hermetically sealed even while the cover is removed.

Machines and Mechanical Devices.

AUTOMATIC FIRING DEVICE FOR SUBMARINE MINES.—G. E. ELIA, Hotel de Crillon, Place de la Concorde, Paris, France. This inventor provides a device for submarine mines in which the cocking and firing are produced automatically by contact between the mine and the hull of a moving ship. More particularly it consists in utilizing for the cocking and percussion, the buoyancy of the mine itself which enables the firing device to act at all depths and temperatures.

NUT CRACKING MACHINE.—J. M. KING, North Vernon, Ind. This invention provides a machines having a member with an opening in which a second member is disposed, the inner wall of the first named and the wall of the second member conveying downwardly, there being ribs on the inner wall of the first member and ribs on the wall of the second member, so that when the latter is rotated and nuts are disposed in the space between the two members, they will be cracked.

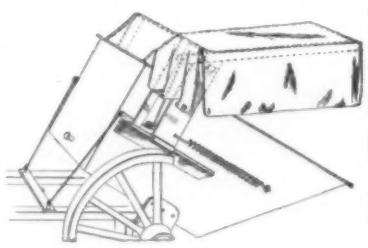
LIFE BOAT RELEASING APPLIANCE.—D. SENACOL, care of Mrs. Miller, 931 Tehoupitoulas St., New Orleans, La. This inventor has in view a construction embodying a hanger and a coupling appliance, the hanger being carried on one of the boat falls and provided with an enlargement or head at its lower end, and the coupling appliances having a socket member to receive the head of the hanger, and hinged to move the hanger laterally and eject it to one side of the coupling appliance.

CONVEYER.—W. J. TURNBULL, New Orleans, La. By the means of the present invention Mr. Turnbull seeks to provide a conveyer especially designed for use in carrying bags of merchandise or other objects which may be rested upon the metallic slabs and then conveyed along by the movement thereof.

CLUTCH.—J. GUSTAFSON, 952 52nd St., Brooklyn, N. Y. In the present patent the invention has reference to clutches, the more particular object being to provide an improved construction of clutch in which the grip is positive and the strength and simplicity of the mechanism greatly promoted.

Pertaining to Vehicles.

DUMPING CART.—LESSER WOLF, 820 E. 155th St., Bronx, N. Y. This cart has a body, there being supports movable relatively to the body to which hood carrying arms are pivoted, the arms being connected with the thills of the cart, so that when the body is dumped the hood will be raised and will be drawn forward relatively to the body. It does away with dust, odors, etc., that originate in an ash cart while being loaded or dumped, or while on the public highway, thereby preventing disease, the usual annoyance to pedestrians and the damage to household effects from the ash cart now in use. The illustration shows a perspective view of the cart with the body in dumping position.



DUMPING CART.

REFUSE WAGON.—L. F. SCHOLZ, 240 W. 132nd St., Manhattan, N. Y. The invention pertains to certain improvements in wagons for collecting refuse, such as ashes or the like, and particularly relates to the specific means for dumping the material from the barrels into the wagon, without creating any dust or scattering any of the refuse.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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HEREDITY IN RELATION TO EVOLUTION AND ANIMAL BREEDING. By William E. Castle. New York: D. Appleton & Co., 1911. 12mo.; 184 pp.; illustrated. Price, $1.50 net.

The chapters are based upon lectures given by the author, who is Professor of Zoology at Harvard University, and treat of such subjects as the quality of inheritance, the mutual independence of germ-plasm and body, the determination of dominance, the evolution of new races by loss or gain of characters, the effects of inbreeding, and heredity and sex. Each chapter is followed by a bibliography, and the whole work presents in text and illustration many actual examples of the working of the laws it cites, the guinea-pig being the animal most frequently experimented with and most frequently used in the illustrations.

ANIMAL SECRETS TOLD. A Book of "Whys." By Harry Chase Brearley. New York: Frederick A. Stokes Company, 1911. 8vo.; 274 pp.; illustrated. Price, $1.50 net.

"Animal Secrets Told" is intended as a stimulant to the young reader's powers of observation and deduction. With its original drawings and its sparkling treatment it should certainly serve this purpose. The fabulists have for ages told us how the bear came to lose his tail, with much pseudo-science of a like nature, and there is no conceivable reason why scientific truth, being stranger than the corresponding fiction, should not prove the more attractive. Certainly it is the more safe, useful, and informing. The "Why" of eyes, noses, ears, mouth, feet, and tails is here strikingly put before the inquiring mind. Tell a child that the animals whose eyes are placed in front are the Hunters, and that those whose widely-separated, side-placed eyes are the Hunted—and you immediately bring down upon yourself a deluge of animated questions and demands for further "secrets." And this is in the first paragraph of the first chapter!

PROBLEMS IN RAILWAY REGULATION. By Henry S. Haines. New York: The Macmillan Company, 1911. 8vo.; 582 pp. Price, $1.75 net.

Mr. Haines has already given us several volumes from the point of view of the practical railway manager, and the work in hand is in some sense a continuation of "Restrictive Railway Legislation" and "Railway Corporations as Public Servants." By first tracing the formative period of the American system the author prepares us for a study of its extension, its reconstruction, and its federal regulation as initially influenced by the Interstate Commerce Act of 1887. We are then informed as to the many and complex problems of management—problems of incorporation, of finance, of construction, of operation, of traffic, of rate-making and discrimination, of capital and labor. The situation as a whole, with the tendencies of the times toward further regulation, is masterfully summed up in the concluding chapter. Here Mr. Haines unequivocally states his position, which is that government regulation should be strictly limited to the provision of safe, convenient, and prompt transportation, and that in all other matters and in details of management the roads should be free to solve the problems in their own way. In other words, the corporations should be held penally responsible for certain results, but the means of producing these results should be left to their judgment. Mr. Haines' solution would leave untouched some vital phases of the questions at issue, but there can be no doubt of the possibility of too much outside interference. His arguments are well worth unbiased consideration.

THE DIAMOND. By W. R. Cattelle. New York: John Lane Company, 1911. 8vo.; 443 pp.; illustrated. Price, $2 net; postage, 15 cents.

The diamond is here made the subject of a very comprehensive series of papers which give their information from all points of view, spectacular, commercial, historical and constructural. The volume is intended both for jewelers and the general public. Celebrated diamonds are minutely described; the mines of India, Africa, and Brazil are given separate chapters and some interesting illustrations; there are discussions covering the buying of diamonds, and of color and flaws, that should prove enlightening to prospective purchasers; and, under conviction that the diamond will eventually be successfully manufactured, the writer gives us some account of the attempts already made, with suggestions for future experiments.

CORPORATIONS AND THE STATE. By Theodore E. Burton. New York: D. Appleton & Co., 1911. 12mo.; 249 pp. Price, $1.25 net.

The author of "Financial Crises" here gives us another thoughtful volume on present-day conditions as affected by modern business in its actions and reactions upon the body politic. The origin and development of the private corporation is traced, the nature of combinations is defined, and the regulation of the corporation by the State is discussed in the light of past attempts and present tendencies. Our financial system is compared and contrasted with the systems in operation abroad, not omitting the underlying reasons for the difference in laws and methods. The work deals with questions of extreme complexity yet of vital importance; questions that no intelligent and educated citizen can afford to ignore; and it deals with them in a plain and impartial style. The appendices quote the opinions in the Standard Oil and American Tobacco cases, and give the Sherman act against unlawful restraint of trade and the Aldrich plan for monetary legislation. Thus the work acquires value as a book of reference in addition to its other features of appeal.

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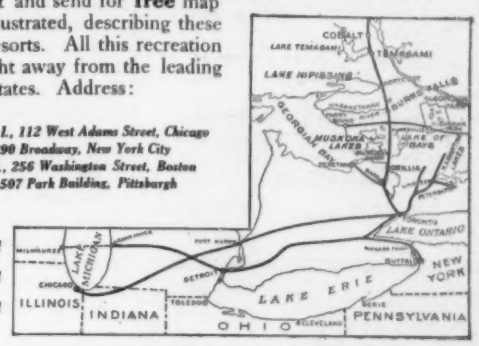

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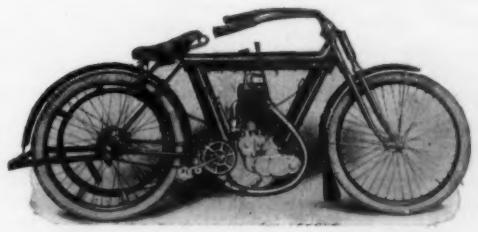

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IV.—Shall My Boy Become a Mining Engineer?

By Henry S. Monroe, Professor of Mining,
School of Mines, Columbia University

[This is the fourth of a series of articles intended to set forth fairly the business possibilities of the technical professions. The articles are prepared by men who are connected with the more important technological institutions of this country and who are for the most part prominent educators. Because these teachers have instructed hundreds of young men in the principles of engineering, they are best qualified to write upon a subject so immensely important in the future development of American manufacturing industries.—EDITOR.]

THE life of a mine may be divided into several stages:

1. Prospecting; or the search for mineral deposits.

2. Exploration; or the proving of the deposit.

3. Development; operations preparatory to mining.

4. Exploitation; that is, operations connected with the extraction of the mineral and its preparation for market.

The training of a young mining engineer, as it has been developed in the thirty or more leading mining schools in this country since 1863, has proved eminently successful and the graduates of these schools are rapidly displacing the men without technical education who formerly had the field to themselves.

A mining engineer must be a good geologist, with training both in theory and in field work, to fit him for the examination of mineral properties and for the work of proving and developing them. The practical man, without such training, can literally see but little farther than the point of his pick. Large amounts of money have been wasted and many sanguine expectations have failed of realization by reason of the mis-directed enthusiasm of uneducated men. The trained mining engineer makes mistakes, it is true, but he realizes the limitations of his knowledge and proceeds with caution, testing carefully every step of the work.

Mining operations, of course, rapidly exhaust any ore body, even those of considerable size, so that the search for new deposits continues through the life of most mining enterprises and in extreme cases this exploratory work may prove to be the largest item of expense in mining operations. There is opportunity here for great saving by carefully planned work in the hands of well trained men.

The development of a mine and the erection of the plant call for engineering ability of a high order. The mining schools therefore provide (or should provide) instruction in the elements of civil, mechanical and electrical engineering for the mining students. The subjects should be taught from the standpoint of mining conditions and mining requirements. The arguments which have been advanced in this series of articles for these professions will therefore apply to the technically trained mining graduate in this part of his professional work.

The actual operations of mining, the support of underground excavations, problems of ventilation, drainage and the hoisting of minerals, provisions for the safety of the men, all demand engineering ability and broad knowledge of the manner in which similar problems have been attacked in other mining regions and in other parts of the world. The practical man, whose experience is often confined to one kind of mining and to the methods of work in a few mines, or mining regions, is not so well fitted as is the man of wider knowledge to cope with new conditions or to attack the new problems which are continually arising.

Among the incidental and minor advantages of a technical education is the training which fits the young graduate for useful work in subordinate capacities. He can find employment at a fair salary either as a draftsman or designer and should be competent to prepare plans and specifications for mine structures. He is familiar with surveying instruments and can plan and execute underground and surface surveys. He has had training in analytical chemistry and assaying, and can readily find employment as chemist or assayer at mines and metallurgical works. And finally, his training in geology, metallurgy, and engineering fits him for immediate usefulness and makes him a valuable assistant in any or all of these directions. His school training and the numerous problems required of him in his field, laboratory and design work give him facility and confidence in attacking similar problems in professional work. He has acquired a wide acquaintance with technical literature and he can readily turn to such sources of additional information when necessary. He has come into intimate contact with professors and lecturers, and has made many friends among engineering students of his own and other classes. After graduation he will meet many alumni of his professional school to whom his diploma will be a very valuable letter of introduction. Such friendships and acquaintances with men of his own and allied professions are likely to be most serviceable.

Mining, like other professions, embraces many specialties; coal mining, the mining of precious metals, the mining of great ore bodies, placer mining, mining for salt, boring for oil and gas, the concentration of minerals, gold-milling, and many others. In these special fields great advances are being made to-day by the graduates of technical schools. We may fairly say that the art, both of mining and of the preparation of minerals, has made greater advances in the last fifty years than in many centuries preceding.

It is, of course, not possible in a mining school to train a young man for the immediate practice of his profession, nor for positions of great responsibility, but like lawyers, physicians, civil, mechanical, and electrical engineers, the young graduate must have his period of apprenticeship in which he shall supplement his school training with training in business matters, in executive duties, and in the practical operations of mining. The trained man, however, can, and does, shorten this period of apprenticeship and takes better advantage of his opportunities and in the end may become more really practical than the practical man, more business-like than the man who has graduated from the bookkeeping staff, and a better executive than the man who has risen from the ranks.

Dust in the Air

(*Concluded from page 497.*)

like that of night prevailed over New England. All but the most necessary business was suspended, the schools were dismissed, and the greater part of the population flocked to church to prepare for the end of the world that appeared to be imminent. Whittier has described this wonderful darkness in his "Tent on the Beach"; when

"Birds ceased to sing, and all the barnyard fowls
Roosted; the cattle at the pasture bars
Lowed, and looked homeward; bats on leathern wings
Flitted abroad; the sounds of labor died;
Men prayed and women wept; all ears grew sharp
To hear the doom-blast."

A similar phenomenon occurred in New England on September 6th, 1881; but on account of the intense brassy appearance that everything assumed it has since been known as "the yellow day of 1881." The cause of the darkness in this case may have been the burning of the immense peat bogs of the Labrador barrens.

Another important, though relatively infrequent cause of atmospheric turbidity is the eruption of volcanoes. The famous dry fog of 1783, which covered all Europe for three months, was probably due to an eruption in Iceland. The eruption of Krakatoa, in 1883, surpassed all other similar phenomena of historic times in the amount of solid matter that was discharged into the atmosphere. The dust from this volcano made the circuit of the

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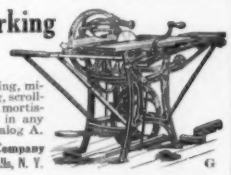

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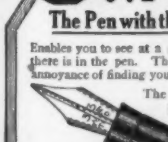

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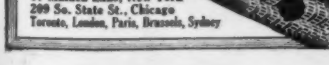

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globe several times. For two years it gave rise to extraordinary sunset glows, "blue suns," the large form of corona known as "Bishop's ring," and other remarkable optical phenomena. Most wonderful of all, the finest particles are believed to have been carried to an altitude of over fifty miles, and to have remained suspended there for several years, buoyed up by air currents. They appear to have constituted the famous "noctilucent clouds," observed on summer nights from 1885 onward. These clouds, which glowed with a silvery luster due to reflected sunlight, resembled cirrus, but evidently occurred at a far greater altitude than any cloud consisting of ice particles.

Yet another impo"tant class of dust is made up of organic matter, living or dead, including the countless myriads of microorganisms. The presence of an abundance of pollen in the air accounts for the occasional occurrence of so-called "sulphur showers," or "golden rain."

There are various methods of measuring the dust in the air. A known volume of air may be drawn through a filter of cotton wool, or bubbled through distilled water, and the dust detained by the cotton or deposited in the water may be weighed. Most forms of apparatus used in studying dust serve only to show the total weight per unit volume of air, or provide means of securing specimens for microscopic examination.

The majority of dust-particles, however, are ultra-microscopic, and it is a matter of much interest—especially in connection with the study of the condensation of atmospheric moisture—to determine the total number of particles, regardless of their weight, present in a unit volume of air at any time or place.

This is effected by means of Aitken's dust-counter, one of the several forms of which is shown in the accompanying illustration.

The instrument is shown, partly in section, at 1. *B* is a shallow circular metal box of known capacity, having glass plates at top and bottom. It stands upon two cylinders opening into it. The cylinder shown at *F* contains a piston, and serves as an air-pump. In the other cylinder there are three taps, *D D D*, the bores of which hold measured volumes of air. At the bottom of this cylinder there is a plug of cotton wool, beneath which there is a small hole through which the air may enter. At *A* is a magnifying glass, and at *C* a reflector, for illuminating the glass plate at the base of the box *B*. This plate is divided into measured squares, etched on the glass (shown at 2). The atmosphere within the box is kept saturated with moisture by means of strips of damp blotting paper.

The instrument is used in the following manner: The piston at *F* is drawn down, while the taps are in the position shown in the diagram. Air is drawn through the plug of cotton wool and thus enters the metal box free from dust. The instrument is now ready for testing a sample of air. One of the plugs is turned so as to communicate with the outside air, as shown at 3. It is then turned back, so that its bore again communicates with the metal box into which a known volume of dusty air is thus admitted. One or two rapid strokes of the piston now serve to cool, by expansion, the air in the metal box; drops of moisture form and are deposited on the glass plate, where they may be counted. (See 2.)

Each of these drops is condensed about a particle of dust: hence the number of drops represents the number of dust particles. The latter may themselves be far too minute to be visible under the highest power of the microscope, but they reveal their presence by becoming the nuclei of condensation.

If the outside air were admitted freely to the metal box and the latter were then closed, the drops formed by sudden condensation would be far too numerous to count. However, by diluting a small volume of dusty air with a large volume of pure air, in the manner above described, the drops are easily counted; and it only remains to multiply the result by a factor

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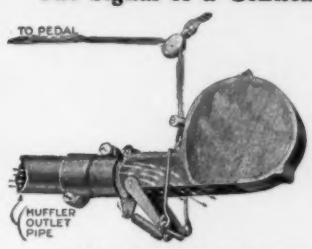

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The Indian Motocycle

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The **Indian's** "flexibility" of speed-control is mainly due to

The Variable Speed And Free Engine Clutch

This device enables the **Indian** rider to regulate his speed from 4 to 60 miles an hour by merely moving the clutch lever the right degree. By this action the clutch can be "slipped" and the machine driven at the speed best suited to the moment.

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In other words, the Variable Speed and Free Engine Clutch is the means by which the motor power is fed to the machine at the will of the rider.

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corresponding to the degree of dilution to determine the dustiness of the outside air, expressed in the number of particles.

Aitken and others have made innumerable tests of the air in all parts of the world. The number of dust particles has been found to vary from a few thousand per cubic inch over the oceans and in mountain regions to 50,000,000 and upward in dusty towns. A room, near the ceiling, has been found to contain 88,000,000 to the cubic inch. Aitken tells us that a cigarette smoker sends some 4,000,000,000 particles into the air at every puff.

Muscle as the Motive Power in Flight

SOME time ago the French journal *Auto* raised the question whether it would be possible for a man to fly by his own muscular power and whether it was possible by means of a bicycle to obtain the initial impulse for achieving an extended gliding flight. This article elicited numerous letters whose writers stated they had already made such experiments with a degree of success. The method followed is to have a bicycle fitted with a propeller which is operated by the pedals and provided with wings which are usually fastened to the shoulders of the rider. One writer stated that he had flown as much as 330 feet by this means.

The idea has naturally roused much interest among bicycle manufacturers, and the Peugeot house offered a prize of 1,000 francs for flight by muscular power alone. The conditions of the prize, which is open till July 1st, are as follows:

1. It must be made with a machine worked exclusively by man-power.

2. Contestants are forbidden to make use of a pacemaker at the start.

3. A distance of 10 meters, to be indicated by two parallel lines drawn on the ground, must be covered.

4. The flight must be repeated in the reverse direction, so as to eliminate aid by favorable wind.

More than one hundred entries have been made in the contest, a proof of the interest it has excited.

The *Allgemeine Automobil Zeitung* quotes some interesting remarks by Georges Prade on the possibility of a successful "aviette." We read:

Locomotion on *terra firma* is made possible by two sources of energy—muscular power of men or animals and mechanical power. From the first wheelbarrow to the automobile, through the intervening steps of the latter, beasts of burden and of draft and the car, transportation has made use of one of these two. Wind power has been only of exceptional use (as in the ice boat) and the same is true of gravity (as in sleds and toboggans).

On the water a third power, that of the wind, has been added to these two. On the earth nine-tenths of the power employed has come from animals. On the water seven-tenths of the power has come from the wind.

Now the question has become a practical one for the realm of air. Here we have previously had on the one hand exclusively mechanical power in the special form of the gasoline motor, and on the other hand the muscular power of birds and insects.

Mammals are five or six times as heavy as birds for a given muscular power. An automobile weighs three or four times as much as an aeroplane with a motor of equal horse-power.

The "heavier-than-air" triumph, therefore, is due entirely to the comparative lightness of the source of power.

Is there a chance of success in meeting the conditions of the Peugeot prize? The history of attempts in this line is neither encouraging nor discouraging. But it may be said that the mechanical aviation of to-day grew out of the attempts to fly by muscular power.

It is not probable that much further progress can be attained in the lowering of the proportional weight of the motor to the machine.

But it may be said that one best learns to fly by actually flying, and it will be interesting to note whether, by a sort of reverse process, the aeroplane, which has been the product of the steadily increasing perfection of the gasoline motor, will ever be so far developed as to be operated by human muscle alone.

The Earth-eaters

ONE of the most odious characteristics of Southern "crackers," as they were described to us a few years ago, is the habit of chewing earth or clay. When Dr. Stiles of the Public Health Service discovered that the low mental and physical condition of these people was due almost entirely to the ravages of the "hook-worm," we learned at the same time that the earth-eating was but a manifestation of a perverted appetite, the perversion being due to the action of the parasites in the food-canal. Whether all earth-eaters suffer from some internal parasite is not known; but the practice of eating earth is much more widespread than the hook-worm is known to be.

The practice is not confined to any race or region of the earth. In America several tribes of Indians, of the Northern as well as of the Southern continent, are given to using earth as food. Different varieties of clay seem to be preferred. The Pawnee Indians used a yellowish clay which they shaped into little balls that were allowed to dry in the air and were then slowly roasted at the open fire. When the clay attained a red color, the balls were removed, moistened with water and eaten. These clay balls were especially liked when served in connection with fish, and seem to have promoted digestion.

The Timmeh Indians of the Mackenzie River used to resort to the earth as food in times of famine. They dug out the clay found in the hollows along the banks of the river. In prosperous years they chewed the clay as a delicacy. The Apaches mixed powdered clay into their meal before baking this into their rude loaves of bread. In South America, the Indians in the uplands of Bolivia ate a light clay that is nearly white in color; this they used either raw or in the form of cakes of various shapes, which are sold in the market places. They also prepare a sauce with the clay; this they eat with boiled potatoes.

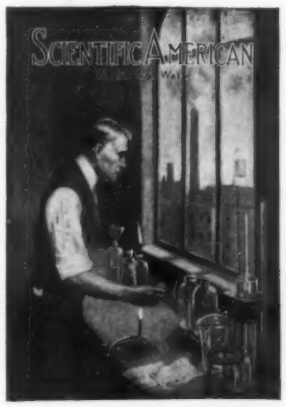
Among the negroes of the Guinea Coast as well as among those in West Africa the eating of clay is very common. The natives of the Sudan dig their favorite clay from between layers of sandstone in the banks of the rivers. The natives of Java prepare little cakes of clay containing ocher; these are sold in the public markets.

The "hairy Ainus," the aborigines of Northern Japan, mix clay with their rice, and with the leaves of various plants which they use as food. In Persia varieties of clay are considered delicious luxuries among certain classes, while in the foot-hills of the Himalayas the natives are constantly chewing a piece of greenish clay, which they believe has the property of protecting them against the goiter.

In Finland as well as in certain parts of Sweden powdered clay is mixed with the flour used for baking bread. This practice is similar to that of the Apaches, and may really represent a relic of some early ceremonial or superstitious observance. In the Ural Mountains the natives mix gypsum ("plaster of Paris") with their dough. In Styria, in Sardinia and in Treviso (the Tarvisium of the ancients, near Venice) cakes of clay are sold in the markets with other food-stuffs. In parts of South America the whites imitate the natives in using clay as an article of diet; but there they cultivate the excuse that eating the earth leads to the production of a fine complexion.

An Honor for Father Algue

THE University of the Philippines, which confers but one honorary degree each year, has bestowed that of doctor of science upon Father José Algué, S.J., director of the Philippine Weather Bureau.



Wealth from Waste

¶ "Give me the sewage of New York city," cried a knowing modern chemist, "and I will return annually the milk of 100,000 cows."

¶ Lord Palmerston voiced the same thought when he said: "Dirt is merely matter in the wrong place." The dump heaps of our forefathers have become our mines.

¶ No fairy story is more fascinating than the tale of the utilization of waste. At the touch of the chemist's wand old shoes are miraculously transformed into jelly; alcohol is wonderously charmed out of old shirts; love-letters are written on what was once an old linen cuff, with ink made from the rusty hoop of an old barrel.

¶ In the next mid-month magazine number of the Scientific American, which will be issued on June 15, the story of making money out of waste will be told in all its fascinating details.

¶ You will learn how coal tar, a noisome ooze that was once thrown away, has become the most protean substance in the world. The chemist has found it to be a palette of gorgeous colors, an arsenal of deadly explosives, a medicine chest of healing potions, a vial of sweet odors—in a word, the most wonderful, complex substance in the world.

¶ You will learn, too, how the packing industries utilize by-products. Nothing escapes the boiling kettle or the machine. A steer is utilized from the tip of his horn to the last hair of his tail.

¶ You will read something of the wonderful story of the transformation of wood waste. For three dollars you can buy a suit of clothes in Germany made of paper yarn—the product of chips and branches. The silk scarf that you wear may be but the transformed block of wood that was thrown away by some reckless lumberman.

¶ In a word, the June mid-month number will show you what Hamlet meant when he inquired:

"Why may not imagination trace the noble dust of Alexander till we find it stopping a bunghole?"

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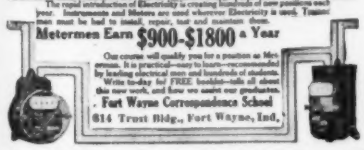

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Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12642) I. F. M. asks: Will you kindly explain the fundamental principles of a compass, and does a compass at all times point to the north? A. A magnetic force in the earth causes the needle of a compass to place itself in a general north and south direction on all parts of the earth. The needle does not point directly and exactly north and south excepting along certain lines called lines of No Declination. The one which passes across the United States enters the country from the Atlantic Ocean in South Carolina west of Charleston, and leaves it about at the middle of the length of Lake Superior. It is quite irregular, but along this line compass needles indicate true north and south. In your State the needles point to the east of true north about 16 to 17 degrees. This variation from true north must be allowed for in all surveys of land. 2. Does the North Star have anything to do with a compass? A. The North Star is not connected in any way with the pointing of the compass needle. It is the star which happens at the present time to be nearest to the line in which the earth's axis points at the present time. In thirteen thousand years this star will be a farther distance from the pole of the heavens. It will not then be called the Pole Star.

(12643) W. O. E. asks: Can a frog or toad live a thousand years in solid rock? A. The Ency. Brit., eleventh edition, vol. 16, page 975, has this statement: "The duration of life among batrachia is little known, but small frogs have been recorded as living over twelve years, and toads up to thirty-six years." This is so far from a thousand years that we think it impossible that a toad can attain such an extreme age. The stories of toads jumping out of a tree when it was split, into which the toad had grown in some remote time, are probably very apocryphal.

(12644) E. E. B. asks: Will you kindly tell me how many stars there are now in our flag, and how many there should be on July 4th, 1912? Also where the last were added and when the next change will be made? A. There should be at present forty-six stars in our flag. We have met the opinion that a star was added immediately upon the proclamation of the President that a State was admitted to the Union. To make certain of the fact we referred the question to the Librarian of the War Department, and have received from him a reference to the law upon the subject. It is found in U. S. Statutes at Large, 3,415, act of April 4th, 1818, and enacts that the star for a new State shall be added to the flag upon the Fourth of July succeeding the admission of the State. In accordance with this law two stars will be added to the flag on July 4th next, making forty-eight stars upon that date. They will be placed, as we are informed, in six rows of eight stars each. The last States to be admitted to the Union were Arizona and New Mexico. Their statehood bill was signed by the President on August 21st, 1911, subject to certain changes in their constitutions. The proclamation of the President has been made admitting these States, and their stars will become a part of the flag on July 4th, 1912.

(12645) H. S. W. asks: A contends that no matter how large or heavy a steel ship is, it will not sink to the bottom of the ocean, on account of the pressure, also that no soundings can be made in water two or three miles deep on the same account. B says a steel boat will go to the bottom, no matter how deep, as the pressure is equal inside and outside of the boat, and that soundings have been made greater than three miles deep. A. We have many times said in Notes and Queries that anything which sinks in water will go to the bottom without stopping. Pressure has nothing to do with the case, since the pressure is equal in all directions, and water is not compressible to any great degree. The sounding wires have reached the bottom of the ocean wherever they have been sent down. A weight of several hundred pounds is attached to the wire, and when the bottom is reached the weight is detached, but not otherwise. The deepest place found lies off the Fiji Islands and is 30,930 feet deep. Near Japan is a place which is 27,600 feet deep, and in the Atlantic a deep has been found north of Porto Rico, where the line went to the bottom in 27,366 feet of water.

(12646) A. P. W. says: I wish to know how many feet under water a diver can go. Is a hundred feet the limit? A. Divers work under water to a depth of 120 feet and even 150 feet, but for a shorter time. We think the record is about 200 feet, but the man who reached that depth did not do any work. He suffered terribly, lost consciousness, and was hauled up.

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AMERICAN HOMES and GARDENS

JULY NUMBER, 1912

THERE is not a single issue of AMERICAN HOMES AND GARDENS that contains an uninteresting article. Midsummer subjects will be handled in able articles by authoritative writers in the July, 1912, Number of AMERICAN HOMES AND GARDENS, exquisitely illustrated. "*The Isolated Power Plant for the Country Home*," by Jonathan Rawson, Jr., and "*The Sanitary Plumbing of the Home*," by Rolfe C. Roberts, will be two of the leading features. Among the other articles appearing will be the following:

OLD ENGLISH BRASS HOOKS
By William T. Phillips

PAINTED FURNITURE
By Abbott McClure and H. D. Eberlein

AN UNCONVENTIONAL BUNGALOW OF HOLLOW TILE
By E. I. Farrington

THE LIVING-ROOM
By Harry Martin Yeomans

THE AMERICAN PAGEANT
By Adelia B. Beard

PORCHES
A double-page feature

A DUTCH COLONIAL HOUSE
By Robert H. Van Court

A MASSACHUSETTS COUNTRY HOUSE
By Gardner Teall

MOTHERS AND DAUGHTERS
By Elizabeth Atwood

THE GARDEN IN MIDSUMMER

Numerous other articles will appear in this July issue.

MUNN & CO., Inc., PUBLISHERS
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Chicago, People's Gas Building

More than 10,000 enthusiastic owners of the 1912

Cadillac

find it all that a motor car should be

More than ten thousand completely contented and enthusiastic 1912 Cadillac owners—more than ten thousand people with no disposition or desire to own any other car—doesn't that present an impressive picture to your mind?

People are accustomed to say that the man who buys a low-priced car will some day own a better one—but the man who buys a Cadillac stops there—whether he has owned a car of higher or lower price.

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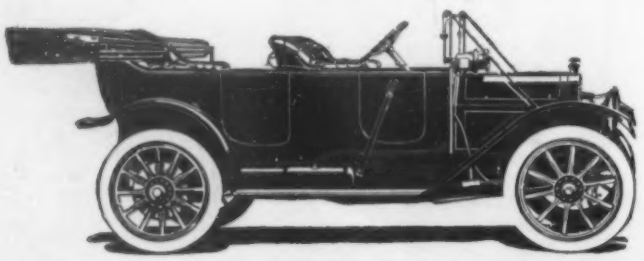
Cadillac owners begin with a dependable electrical system that automatically cranks and lights the car—features exclusive in the Cadillac. They check over everything that the Cadillac is and does—and find nothing in which they would ask for improvement.

For example: the excellence of the Cadillac engine is actually axiomatic in the engineering world. It is accepted not merely as the finest type of engine extant at the Cadillac price—but as a type and a pattern of engine excellence the world over; and at any price.

More than thirty-five thousand four-cylinder Cadillac engines have, in advance, established the unimpeachable reliability of the motor which the 1912 owner finds in his car. He knows that he may expect the superlative of service from the careful and costly principle of "built-up" and "individual-part" construction; and his expectations are not disappointed.

Cadillac methods of cylinder-and-piston measurement—reduced to the minutest accuracy known to the manufacturer of motor cars—have advertised that phase of Cadillac construction in the remotest corners of the world.



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Carburetor, clutch, transmission, steering mechanism, springs, brakes and control, drive and axles—space does not permit of our discussing them all—but each and every one of them reaches that high Cadillac standard of performance which permits no higher standard.

And in that last sentence you have a glimpse of the true source of Cadillac contentment and enthusiasm—the Cadillac makes its own standard in every part and phase and function that goes to make a motor car what it should be.

The Cadillac does not aspire to an ideal set by someone else—it makes its own ideals and raises them higher and higher.

The Cadillac does not strive after the achievements of other plants—it is a school and a model in and unto itself.

Cadillac Motor Car Co., Detroit, Mich.